STANDARD TEXTBOOKS ON PRINTING

LINOTYPE MECHANISM

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UNIT III
LINOTYPE MECHANISM

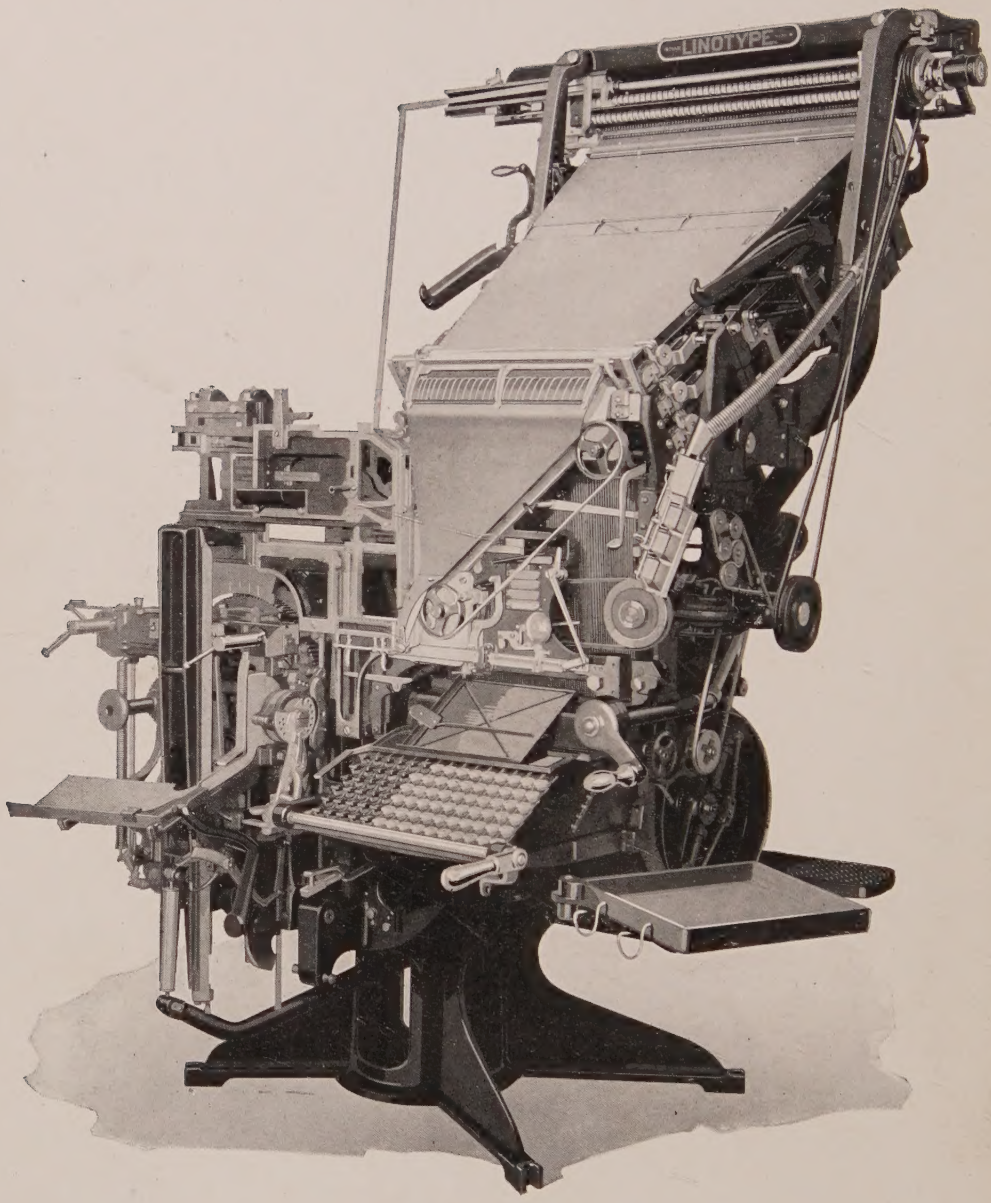

ILLUSTRATION A

Model 8 Three-Magazine Linotype, upon which are based all detail illustrations in these lessons.

STANDARD TEXTBOOKS ON PRINTING

LINOTYPE MECHANISM

By
RAYMOND MEANS *and*
ALVIN G. SWANK
Instructors, U. T. A. School of Printing
Indianapolis, U. S. A.

CHICAGO
DEPARTMENT OF EDUCATION
UNITED TYPOTHETAE OF AMERICA
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INTRODUCTION

This textbook has been produced in an endeavor to furnish a much-needed text or reference book dealing with the mechanical action, adjustment, and the care of the Linotype machine, for the aid of the student, the user, and the experienced worker. This work is now offered as one of a series of Standard Textbooks on Printing issued by the Department of Education of the United Typothetae of America. It takes the place of Unit III, Group Nine of what was formerly known as the U. T. A. Standard Apprenticeship Lessons for Printers.

These lessons are intended for a thorough study of the construction and mechanical adjustments of the machine so that it may properly be cared for, to avoid unnecessary troubles, and to meet any unexpected contingencies that may arise, to the end that the machines may always deliver maximum producton with minimum expense for upkeep. Simple terms, which will enable the student to grasp the fundamentals quickly, have been used throughout the book, but when the name of a part is necessary, the catalog name is used. Ample illustrations are also used to assist in locating the parts mentioned, and to aid in giving a thorough understanding of the machine, its actions, and adjustments.

Plan of the Lessons. The work is covered in twenty-eight lessons. Each lesson deals with a specific part or unit of the machine, and presents, first, a clear description of the part; second, a series of carefully graded exercises for practice in making the adjustments in the parts under consideration; and third, questions for review or for testing the knowledge of points that should have been learned either by study of the text or through the practice work.

Authorship of this Textbook. The text matter of these lessons represents the work of men of wide experience, both in the commercial and newspaper shops, and as instructors

on the Linotype. The original text was produced, and the illustrations selected, by Raymond Means and Alvin G. Swank, instructors in the Linotype Department of the U. T. A. School of Printing at Indianapolis. The text matter was used in this department in proof form with several classes, such revisions being made from time to time as seemed best to make it easily understood by the student. The text matter was then submitted to the Mergenthaler Linotype Company for critical reading by instructors in their schools. We are indebted also to this company for the use of the electrotypes, and to Henry T. Hemming, assistant director of the U. T. A. Department of Education, for their preparation for the text. These lessons therefore represent the best effort and most thorough criticism, both in technical content and in teaching form.

FRED J. HARTMAN
Director of the Department of Education
July 1, 1926 United Typothetae of America

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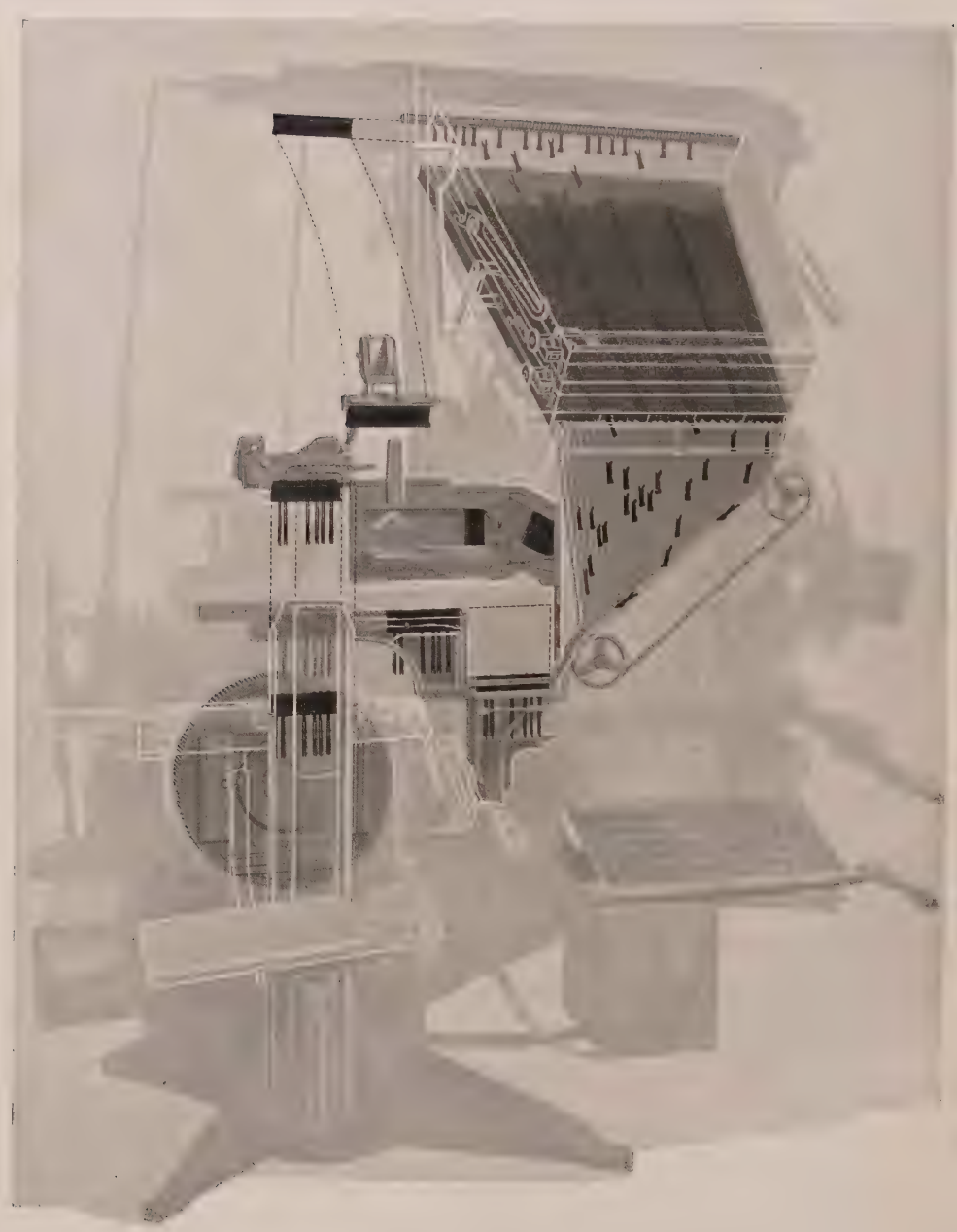


ILLUSTRATION B

This phantom illustration shows each stage of the circulation of the matrices through the Linotype.

LINOTYPE MECHANISM

LESSON 1—THE KEYBOARD

All Linotypes are built along the same general principles, the entire machine being built to handle the circulating matrix. The chief difference in the various models lies in the number of magazines a machine will carry at one time, and the method of changing, or bringing the various magazines into use.

The Model 8 Linotype. The Model 8 is now generally recognized as the standard machine, and these lessons are written in terms of this model. If the student obtains a thorough knowledge of this model, he should be able, without further instruction, to handle any other model.

Designation of Positions. In all of the following text matter, whenever the words right-hand or left-hand side are mentioned, it means the right hand or left hand of the person facing the front of the machine, unless otherwise noted. Many parts and adjusting screws are in pairs on the machine, but attention is called to one in the illustration.

Fundamental Features of the Linotype. The Linotype has four major divisions:

1. The Magazines, which contain the matrices. They represent type cases. Because every matrix circulates automatically back to its place in the magazine as soon as it has served in a line of composition, a font of matrices is small in number compared with a font of types. Therefore a magazine is so compact and light that the operator can handle it without exertion, and can produce any variety of composition by simply changing magazines.

2. The Keyboard and its related parts. This controls the release of the matrices from the magazine in the order in which the characters are desired. The Linotype operator, from his seat at the keyboard, has complete control of every function of the machine. His duties are limited merely to operating the keyboard keys—justification and distribution are mechanically automatic.

3. The Casting Mechanism. The justified line of matrices is presented automatically to the casting mechanism, molten type-metal flows into the indented characters on the face of the matrices, and the cast line, a single unit with a new type-face, delivers itself to the galley on the machine, precisely trimmed and ready to go into the form.

4. The Distributing Mechanism. When a line of matrices has served for casting the line of type, it is lifted automatically and carried to the top of the magazine, where, by a

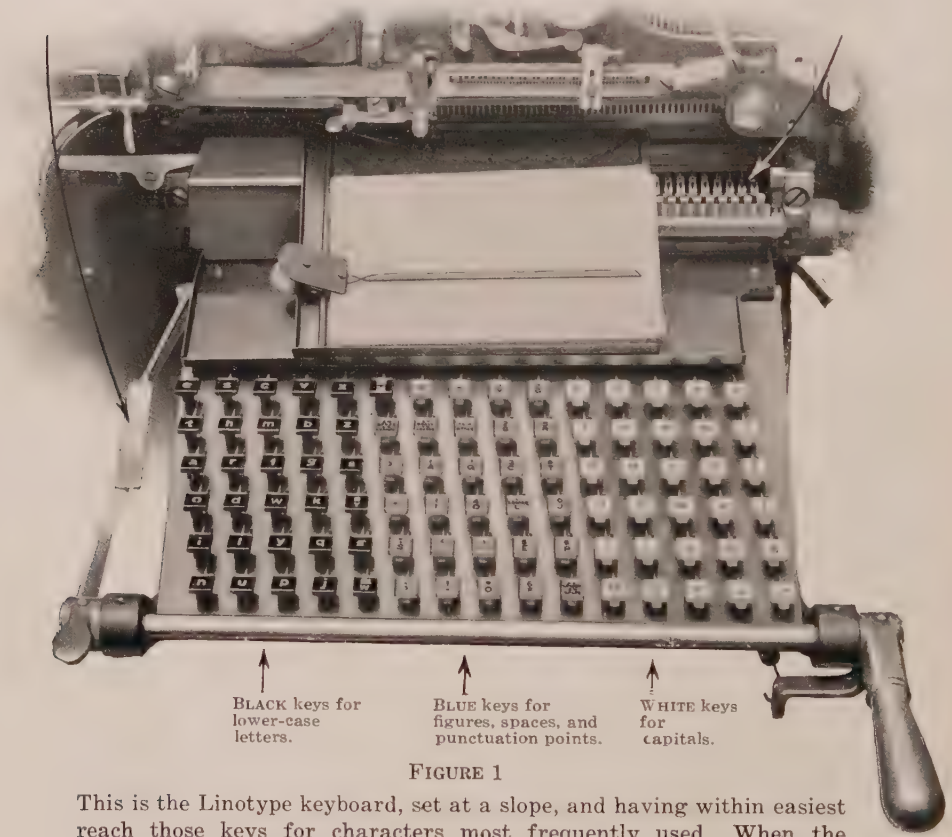

Spaceband Key
Row of Keyboard Cams
BLACK keys for lower-case letters.
BLUE keys for figures, spaces, and punctuation points.
WHITE keys for capitals.

FIGURE 1

This is the Linotype keyboard, set at a slope, and having within easiest reach those keys for characters most frequently used. When the operator touches one of these keys, the desired character is immediately released. Or if he touches the spaceband key, a spaceband is released and dropped.

simple though ingenious system, each matrix is delivered unerringly to its proper place in the magazine, and is ready to serve again.

The Keyboard. The keyboard consists of the frame; the key levers (*a* figure 2), extending through the slots to the back of the keyboard frame; the fulcrum rods (*b* figure 2), which are the pivot rods for the key levers; the keybars (*c* figure 2) that groove into the rear end of the key levers; keybar banking bar (*d* figure 2), fastened to the right-hand and left-hand keyboard posts, holding the keybars in

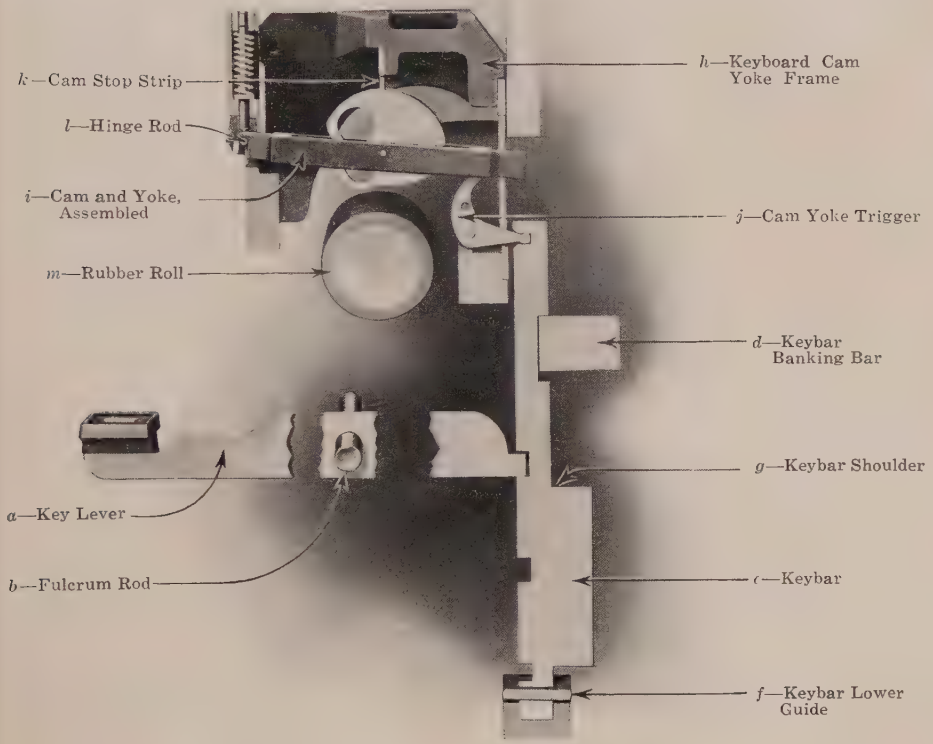


FIGURE 2

In this figure are shown the various parts of the Linotype mechanism by which the operator's downward key pressure is transmitted into an upward pressure which releases the matrix.

place; the keybar guides (*f* figure 2); and the keyboard locking bar that sets above the shoulder of the keybar at (*g* figure 2). The various parts of the keyboard are held in their respective places by the keyboard frame.

Keyboard Cam Yokes and Frames. Mounted on the top, at the rear of the keyboard, are the two cam yoke frames (*h* figure 2). The keyboard cam frames contain the cams and the cam yokes, assembled (*i* figure 2); the cam yoke triggers (*j* figure 2); the cam stop strips (*k* figure 2); the

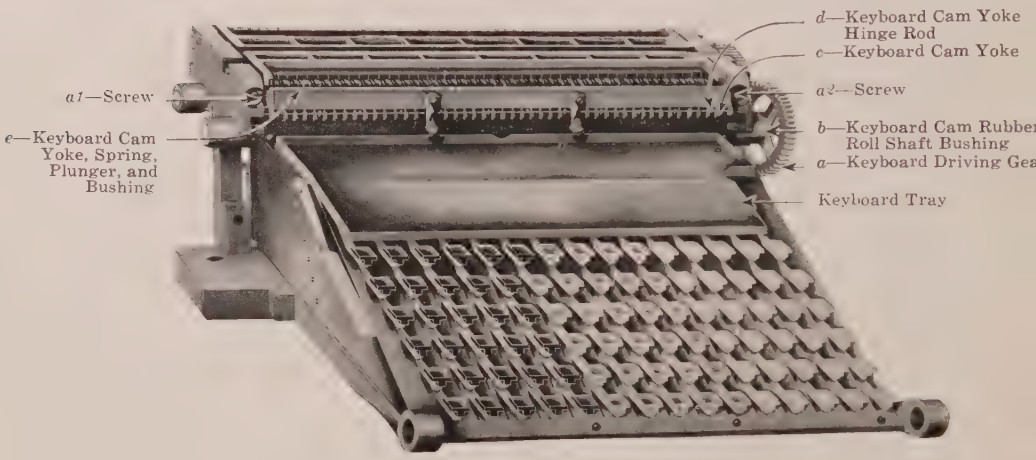


FIGURE 3

This is the Linotype keyboard and cam frame.

hinge rods (*l* figure 2); the rubber rolls (*m* figure 2); the rubber roll shafts, with the pulley, gears, and friction spring, assembled (*a* and *b* figure 3). The frames are fastened to the keyboard posts by a screw at each end of the frame (*a1* and *a2* figure 3), which extends through the rubber roll shaft bracket. Both the frames are equipped with cover pans.

The Keyboard Action. The keyboard action for releasing a matrix from the magazine is as follows: When the key button is depressed it lowers the front end of the key lever, raising the back end. The key lever raises the keybar. The keybar raises the lower end of the trigger, causing the upper end to tilt. This allows the free end of the cam yoke

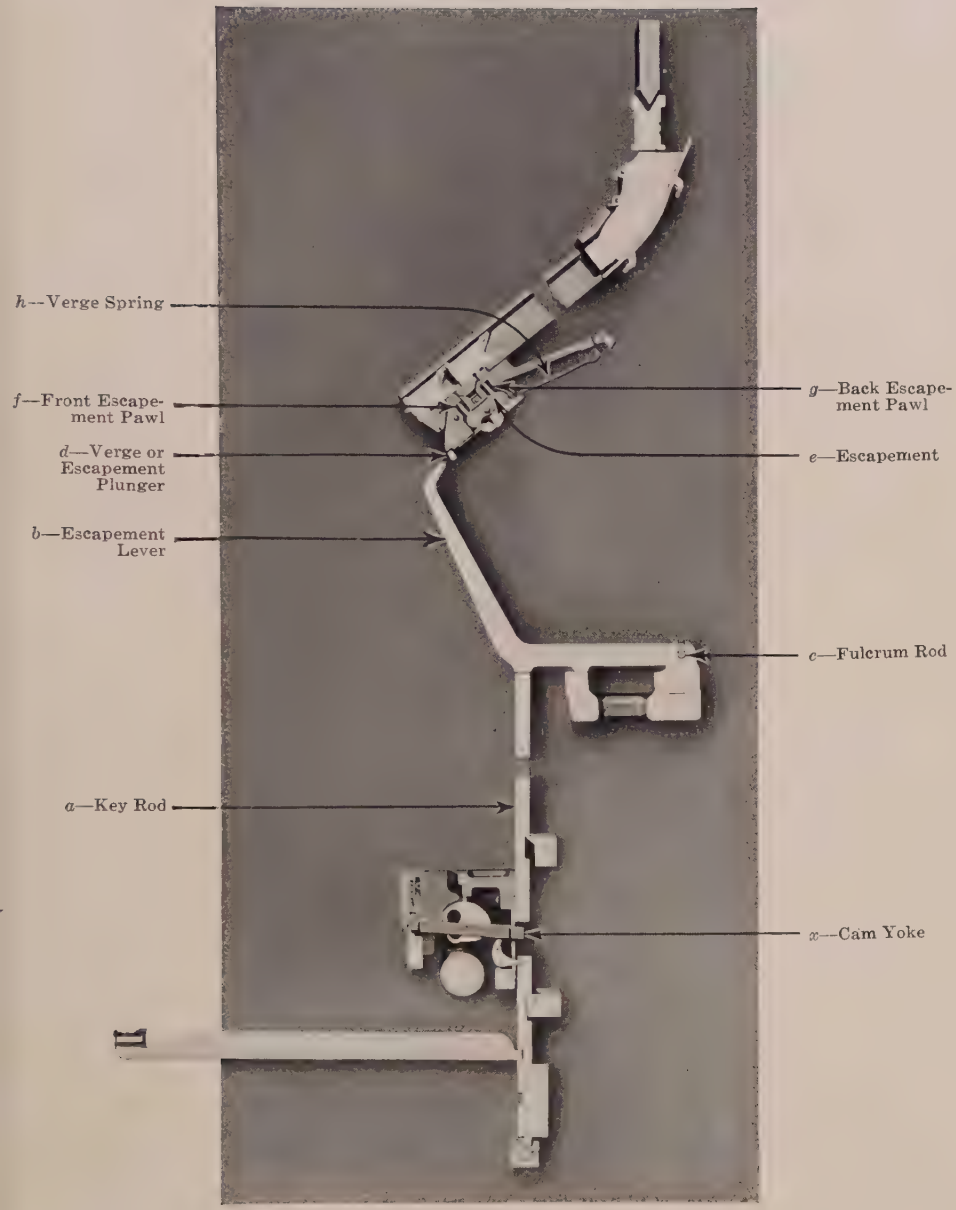


FIGURE 4

This shows the path of the action started by the touch of the finger on a Linotype key.

to drop, causing the cam to engage the revolving rubber roll. The cam is revolved by the rubber roll, and as it reaches the high point it raises the free end of the cam yoke. This end of the cam yoke engages the key rod (*a* figure 4) and causes it to be raised, which raises the escapement lever (*b* figure 4), which is fulcrumed at (*c* figure 4). The escapement lever strikes the verge plunger (*d* figure 4), which forces the escapement (*e* figure 4) to rock, bringing the front pawl (*f* figure 4) down, releasing the matrix; and sending the back pawl (*g* figure 4) up, holding the second matrix from following the first one. The cam has now made a complete revolution, the keyboard and escapement lever have dropped to their normal position, and the verge spring (*h* figure 4) has pulled the escapement to normal, causing the front pawl to go up, holding the matrix which has been released by the back pawl as the column of matrices slides down the channel.

Keyboard Parts. The key levers extend through slots in the keyboard frame and are pivoted near their center on the fulcrum rods. The front end of the key levers carry the key buttons and the back end fits into notches in the keybars (figure 2).

The keybars are held in place on the back of the keyboard by the banking bar and the upper and lower keybar guides. The keybars have notches on the upper end into which the triggers set (figure 2). Also there are notches into which the key levers extend, each bar having three notches, one of which will register with the key lever.

In removing the bars for cleaning, always take them off in groups of six and keep them in order so that no difficulty will be experienced in replacing them. It is always better to replace each bar in its original place after having them off.

The keyboard locking bar extends across the back of the keyboard, just above a shoulder on the keybars. When this bar is forced down it prevents the keybar from being raised, thus locking the keyboard.

Keyboard Cams and Parts. The keyboard cams (*a* figure 5) are small brass non-circular or eccentric pieces and are used to raise the cam yokes to operate the key rods.

The cams are pivoted and held in place in cam yokes. The outer end of the cam yokes are pivoted to the frame, while the inner ends (*x* figure 4) are left free to move up or down in slots in the frame, directly underneath the key rods.

When the cams are setting at normal, the free end of the yokes are supported by the pivoted triggers, which set directly beneath the yokes. (See figure 2.) When a trigger is moved by the keybar, it allows the free end of the yoke to

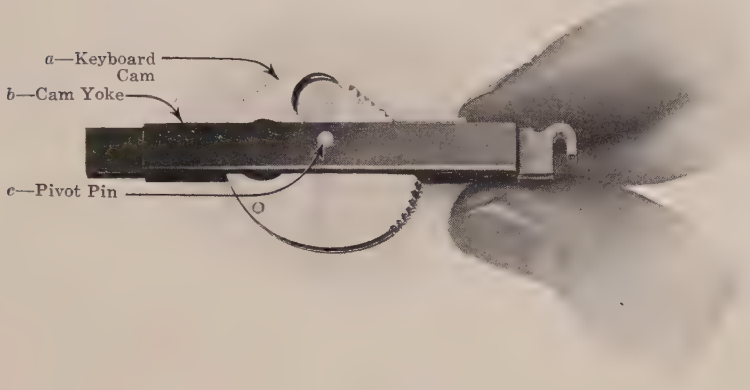


FIGURE 5

The keyboard cam is an eccentric piece pivoted and held in place in a cam yoke, which it raises to operate the key rod.

drop, carrying the cam against the revolving rubber roll. The low part of the cam has small teeth cut in it, so when it drops on the revolving rubber roll, it is caused to turn. When the high part of the revolving cam is on the rubber roll, the free end of the cam yoke is raised to its highest point, raising the key rod.

There are ninety-one cams and yokes in a keyboard. In order to get the cams in the smallest possible space, forty-five of them are located in the front frame, and forty-six in the back frame. The cam on the right-hand end of the back row is used to operate the spaceband key rod.

A stop strip (*k* figure 2) is fastened by means of six screws to each cam frame in such a manner that the small cross pins in the revolving cams come in contact with small pins which extend downward, stopping the cams after their

revolution and holding them in normal position. The front strip has forty-five teeth and the rear strip has forty-six teeth. The strip should be located so the teeth do not bind the sides of the cams.

The top row of keys on the keyboard operate the cams in the back frame, the keys in the second row operate the cams in the front frame, the third in the back, etc., alternating for each row, so when tracing keyboard troubles it is known in which frame an offending cam will be found.

The pivoted end of the cam yoke (*c* figure 3) is hooked over the hinge rod (*d* figure 3), and is held down by a spring and plunger (*e* figure 3) directly above the yoke in the bar. This spring and plunger takes the strain off the yoke and key rod when in an unusually heavy pull, and prevents damage to the rubber rolls.

On the top of the spring bar (*e* figure 3) is an adjusting screw bushing through which the plunger projects. This plunger is forced against the top of the cam yoke by the spring. As the free end of the cam yoke raises, this spring must be strong enough to hold the pivoted end of the yoke from raising more than enough to give the full stroke of the key rod. If something prevents the free movement of the escapement, the strain would come to the pivoted end of the yoke, forcing the plunger up, thus releasing the key rod, cam, or rubber roll of undue strain.

To remove a single cam from the frame, take off the cover pans, touch the key button of the desired cam, release the latch and tilt the spring bar, turn the rubber roll by hand until the cam makes one-half revolution, then lift out the yoke and cam.

Keyboard Rubber Rolls. The rubber rolls are held on shafts which extend through the cam frame. The right end of each shaft runs in a bushing bearing which is held in the cam frame by a screw extending through the cam frame bracket into the shaft bushing. Two kinds of rubber rolls may be obtained: corrugated and ground. The rolls must be kept free from oil at all times. About once each month they should be removed and washed with soap and water to remove all oil, and freshen the rubber. To increase friction the rubber roll may be roughened by the use of coarse

sandpaper, rubbing from end to end and turning the roll so it does not become flat. The roll should be wiped after using the sandpaper to remove the small particles of rubber or sand that may be adhering to the surface.

If the rubber rolls become worn until they are grooved where the cams operate on them, or if they become hard with long use, they should be replaced with new rubber. Good, live rubber rolls have much to do with quick, even response of the matrices.

The rubber roll shafts are driven by friction, so that if anything binds unduly the shaft will stop, preventing damage to the rubber.

The rubber roll shaft carries a shaft collar, taper pin, and oil collar on each end. This assembly must be removed on one end before the roll can be removed. The shaft collar is held to the shaft by a taper pin and the oil collar is forced over the top of the pin and collar. This oil collar must be driven off, using a hammer and a piece of brass rule, before the pin can be driven out and the shaft collar removed.

To replace a rubber roll, remove the oil collar and shaft collar, remove the old roll, polish the shaft, using care to clean thoroughly. A new roll must fit tightly and if the shaft is not clean and smooth, it will be hard to force the new roll on. Place the shaft in an upright position, start the end of the roll over the end of the shaft. Place the thumb or hand over the other end of the roll to hold in the air, and push down on the roll until it is in position.

Keyboard Layout. There are two standard layouts in common use. The one most commonly used, especially in commercial shops, has the small capital layout shown on the key buttons. The fractions run as side sorts when this layout is used. In the other standard layout the fractions are run in the keyboard. This is frequently used on newspapers for setting markets, stock reports, and tables, where a great number of fractions are used.

SHOP PRACTICE

1. At the machine, find the location of each of the parts shown in Figure 2.

2. At the machine, find the location of each of the parts shown in Figure 4.

3. Study the action of the various parts shown in Figure 4 when in operation.

4. Remove the rubber roll shafts and rubber rolls assembled from the cam frames and clean the rolls.

5. Examine the friction on the rubber roll shaft driving pulley.

6. Remove, examine, and replace a single keyboard cam and yoke.

QUESTIONS

1. What are the major divisions of the Linotype machine?

2. Explain the function of each of the major divisions.

3. How is a single keyboard cam and yoke removed from the frame?

4. What care should the rubber rolls be given?

5. How are the keyboard rubber roll shafts driven?

6. What supports the cam yoke when it is setting at normal?

7. What gives the keyboard cam yoke its motion to raise the key rod?

8. Describe in detail the action of the keyboard mechanism, when a key is touched.

9. What stops the revolution of the keyboard cam after a key has been touched?

LESSON 2 — ESCAPEMENT MECHANISM

The Key Rods. The key rods rest just above the free end of the keyboard cam yokes and extend upward to a curved lever (see figure 4) known as the escapement lever, which in turn operates the escapement. They are held in place by two guides. The lower guide is between the cam frames. The upper guide is underneath the escapement levers.

The key rods are held from touching the free end of the keyboard cam yoke by the keyboard key rod banking bar. This bar fits into grooves in the back, near the bottom end of the key rod, and is fastened to the keyboard frame posts directly above the back keyboard cam frame

When placing key rods in the guides, start at the left-hand side with the first slot in the bottom guide, but leave the first slot open in the top guide. This guide slot is for an extra key rod for use in the special double "e" attachment which may be applied. The keyboard banking bar must not be placed in position until all of the key rods are assembled in the guides.

The key rod is returned to position by the weight of the escapement lever after a matrix has been released, the verge spring pulling the escapement back into position.

The Escapement Mechanism. The escapement mechanism consists of two pawls (*b* and *c* figure 6), a verge (*a* figure 6), a plunger (*e* figure 6), and a verge spring (*g* figure 6), for each character in the magazine. One extra for an extra channel of lower case "e."

The verge is hinged on a pivot rod (*d* figure 6). The lower end of the pawls are seated in the verge, and the upper end projects through the under side of the magazine and engages the lower lugs of the matrices (see figure 6). When the escapement is at its normal position, the front pawl extends up into the magazine and holds the column of matrices in the channel. The end of the back pawl is flush with the bottom of the channel groove. The verge and pawls are held in this position by the verge spring which hooks

onto the verge. The verge spring, which sets directly back of and against the verge, has its tension downward on the verge. When the key is touched and the cam yoke raises the key rod, it raises the escapement lever which strikes against the plunger. The plunger operates the verge. This action lowers the front pawl and raises the back pawl, releasing the front matrix. The back pawl detains the other

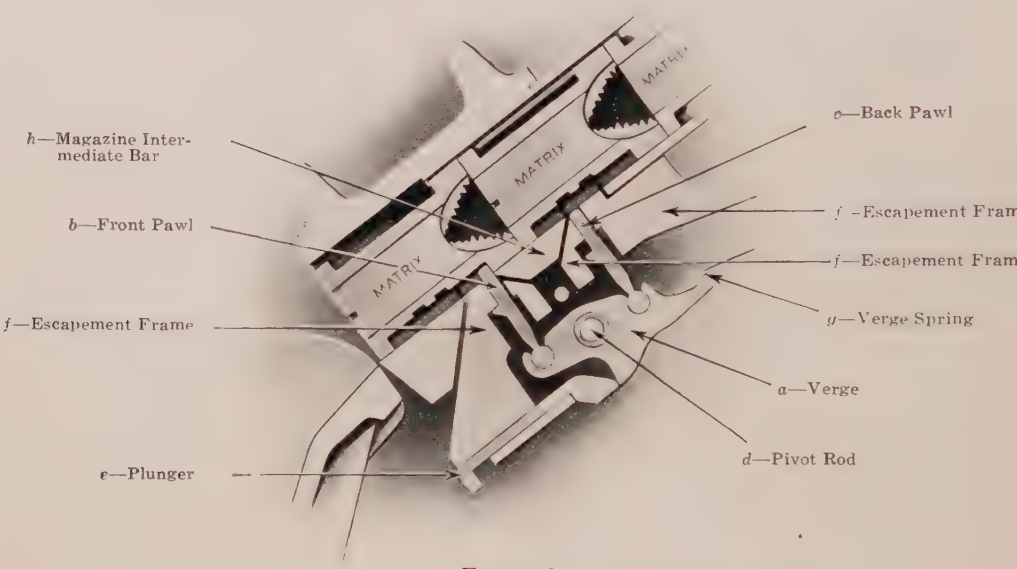


FIGURE 6

This mechanism is called the escapement. It permits the matrices to drop out of their channel.

matrices, holding them in the channel until the verge is restored to normal by the verge spring. This brings the front pawl up and the back pawl down, letting the matrix slide to position ready for the next escapement. The escapement frames are hinged to the magazine frame by the shoulder pins and are held in place by clamps that fit over the top of the magazine. The clamps are held tight by screws with knurled knob handles for easy tightening.

To remove the verge escapements it is necessary to lock the matrices, release the clamps, take off the magazine, and take out the shoulder pins at each side of the frame.

At the left side of the escapement frame is a safety lock which makes it necessary to always lock the matrices with the magazine locking strip before the escapement frame can be dropped.

When it is desired to unlock the matrices, it is necessary to press down on the magazine matrix locking strip latch which is on top of the escapement cover, before the strip can be pulled back.

SHOP PRACTICE

1. Remove an escapement frame and study the action of the various parts.

2. At the machine, examine the key rods and the key rod guides.

3. At the machine, examine the escapement levers and the escapement lever guides.

4. At the machine, see how the escapement levers clear the escapement frames when the magazines are shifted.

5. At the machine, examine the screws and the clamps that hold the escapement frame in position.

6. Examine the safety lock on the left side of the escapement frame.

QUESTIONS

1. What gives the verge its action to release a matrix?

2. What restores the verge to normal after a matrix has been released?

3. How is the escapement mechanism removed from the machine?

4. Describe in detail the action of the escapement mechanism when releasing a matrix.

5. How many key rods on the machine?

6. How many escapement levers on the machine?

7. Why has the upper key rod guide an extra slot?

LESSON 3 — CARE OF THE KEYBOARD

The keyboard and the cams require a little care to keep them working properly. Whenever the keyboard cams become dirty and several of them are causing trouble, the cam frame should be removed from the machine, and the entire set taken from the frame and cleaned. Do not take the entire set off, however, every time a cam fails to act. If there are but a few cams bothering, it is much quicker to take out these individual cams and clean them.

To Remove the Keyboard Cam Frames. Take off the cover pans and the cover tray, remove the two screws (*a1* and *a2* figure 3) that extend through the rubber roll shaft bracket and pull the frame off the dowel pins.

Cleaning the Keyboard Cams. To clean the cams, after taking the frames off the machine: Take out the rubber rolls, assembled, by releasing the set screw that holds the rubber roll bushing to the right-hand bracket; release the pivot end of the cam yoke and remove the cams. The sides of the cam yokes at each end and the outer surface of the cam should be thoroughly cleaned. Dry the cam by wiping with a lintless rag and blowing with an air hose or bellows. The triggers should then be removed and cleaned. While the cams and triggers are out of the frame, the frame should be washed clean. Gasoline or denatured alcohol should be used for washing and cleaning the various parts. A jeweler's brush will be found useful in cleaning the various parts.

Before replacing the triggers, polish them with graphite and string them on a pivot wire to make sure that no dirt nor grit has gotten into the pivot holes during the cleaning.

Clean the rubber rolls before replacing them.

Before replacing the cams in the frame the pivots should be oiled. Use only a good grade of clock or watch oil and put a small drop on the pivot. A broomstraw, ordinary pen, or a small camel hair brush will be found convenient for applying the oil. Be sure to wipe off all surplus oil to prevent its being transferred to the rubber rolls.

The entire set of cams will usually need cleaning and oiling every three or four months in the average shop. Due to some particular shop surroundings, this time often varies.

Before replacing the frames in position on the machine, see that the bracket screws that extend into the frame at each end are loose. If the screws draw the brackets too tight, difficulty will be experienced in seating the brackets to the dowels on the posts. Be sure to lock the keyboard cam yoke triggers by running a wire through the upper holes in the triggers. This is done so the triggers will enter the slots in the keybars. See that all cams are in normal position. This is necessary so the cam yokes will pass under the lower end of the key rods.

To Take a Keyboard Apart. Whenever it is necessary to take the keyboard apart to clean, it should be removed from the machine in the following manner: Remove the cam frames. Remove the assembling elevator lever. Procure a strip of wood furniture fifteen inches long, which is the proper length to just pass inside of the frame posts, fasten a strong cord to each end of the wood strip, take off the keyboard locking bar, place the strip of wood along the back of the keybars, bring the string inside of the side posts to the front of the keyboard. Draw the two ends of the string tight, so that the strip can not move, and fasten it to the key levers. Take out the two keyboard side plate bracket screws (on each side of the rear of the keyboard frame). Take out the four keyboard front plate screws. Remove the two screws which hold the keybar banking bar to the posts and pull the bar off the dowel pins. Pull the frame toward the front of the machine and lift it out. Place the frame on a bench or table in a slightly inclined position with the rear end the higher. Take out the lower row of key levers by removing the fulcrum rod. Take off the keybars, keeping them in their regular order. Take out the remaining key levers by removing the fulcrum rods. Wash the key levers in denatured alcohol or gasoline, brushing vigorously with a jeweler's brush the parts that come in contact with the frame. If there is any corrosion left, polish the levers with metal polish; wipe them dry with a clean rag. The keybars should be cleaned in a like manner, but rub each side of each

keybar on a graphite board instead of using metal polish. Wash the frame of the keyboard thoroughly, and wipe dry. If an air hose is available, blow all the parts dry with the air.

When reassembling the keyboard, work upward. Place the lower row of key levers in first, run the fulcrum rod through the holes; then assemble the next rows, using the same procedure for each row. This method makes it easy to assemble the key levers.

After the board has been assembled, test out each key to see that it is working freely, before replacing the strip of wood. When testing out the keys, make sure that the frame is not in a twist.

When replacing the banking bar the slot in the keybars must fit over the bar; raise up on all the keybars with the plate extending underneath them until the banking bar dowel pins fit into the dowel pin holes.

SHOP PRACTICE

1. At the machine, trace out the various parts necessary for the removal of the keyboard cam yoke frames.

2. Remove and clean the keyboard cam and yokes, assembled.

3. At the machine, trace out the various parts mentioned for the removal of a keyboard.

4. Take apart and clean the keyboard.

QUESTIONS

1. How are the keyboard cams and yokes cleaned?

2. How are the keyboard cam frames removed from the machine?

3. What should be done with the keyboard cam yoke triggers after cleaning them?

4. How are the triggers locked before replacing the cam frame? Why?

5. What should be done to the keyboard before replacing it on the machine?

6. Why is it necessary to keep the keybars in groups of six?

LESSON 4 — MATRICES AND MAGAZINES

The Matrix. The Linotype matrix (figure 7) is shown exact size. This small piece of brass is the basis of everything the Linotype does.

On the back edge (turned forward in the illustration) you will see the characters indented into the matrix. It is from these that the raised characters are cast on one edge of the Linotype slug.

The Linotype is, in simplest terms, a machine for (1) setting a number of these matrices into a row or line, (2) automatically spacing that line to a desired length, and for

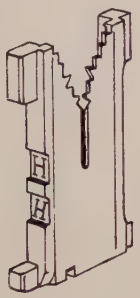


FIGURE 7

This is a Linotype matrix. It is made of brass and is the basis of everything the machine does. It is from the indented character on the matrix that the raised characters are cast on one edge of the slug. This matrix shows a roman and an italic character.

(3) holding the indented characters of this line up against a casting mechanism of which they become a part and which casts the line on one bar, or slug, and then for (4) lifting this line of matrices up and carrying them back to their original position in the magazine, where they can be used again.

Note the key-like teeth on the top. Each character has a different set of teeth. These guide it back to its proper place for repeated use.

Each of these matrices require an average of 57 different operations of extreme precision and continuous careful inspection during the course of manufacture.

The alignment of the letters or characters on a slug is governed by the lugs on the matrices. If these lugs become sheared or damaged, they should be removed from the font at once, and replaced with new ones.

Magazines. The magazine is the receptacle in which a font of matrices is stored on the machine, ready for instant use as the matrices are desired in assembling a line. The magazine or channel plate consists of 92 channels milled in the brass plates, which guide the lugs of the matrices and keep them in line, so as to pass the escapements one at a time.

The No. 5 (English) magazine is the standard magazine. The machine carries three of these No. 5 magazines. All

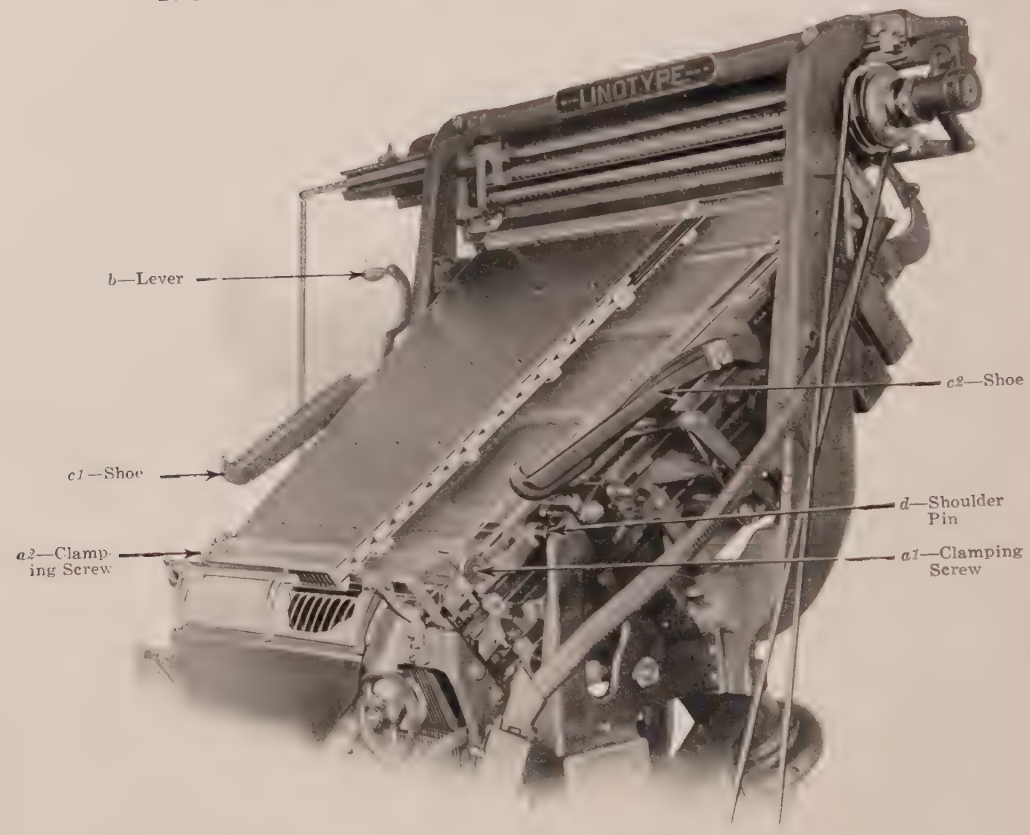


FIGURE 8

Linotype matrices are stored in magazines, from which they are released as shown in Figure 6. In this illustration the upper magazine has been cut away longitudinally to show all the matrices of one character in the "channel" which retains them.

magazines may be removed from the front of the machine. The magazines are interchangeable as to their position in the machine. They are also interchangeable with the same No. 5 magazines on other machines. Any one of the three magazines may be brought into operating position in the following manner: With the right hand turn downward on the crank at the right of the keyboard until the magazines are raised slightly. Press down on the operating lever with the left hand, and turn the crank until the desired magazine is in position. Turn the crank clockwise to raise the magazines; counter-clockwise to lower them.

Figure 8 shows a cross section of a magazine. It also shows the way the three magazines are placed.

Removing a Magazine. It is sometimes necessary to remove the magazines of a machine for the purpose of cleaning or repairing, or to change the type face.

Read carefully the instructions for the removing of the magazines until you become thoroughly familiar with the order of procedure. To forget one operation or to perform an operation at the wrong time may cause the matrices to be spilled or something more serious.

To Remove a Magazine From a Machine. Put the magazine in operating position next to the one to be changed; if the top one is to be changed, put the second magazine in operating position; if the second, place the lower magazine in position; if the third, elevate the magazines as high as they will go. Lock the matrices with the locking strip; pull the lever (*b* figure 8) at the left down as far as it will go; drop the escapements down by releasing the two knurled knob screws (*a1* and *a2* figure 8) that clamp the escapements over the top of the magazine. Fasten the two shoes (*c1* and *c2* figure 8) over the shoulder pins (*d* figure 8) for the magazine bar to slide on and lift off the magazine from the front.

There are many Model 8 Linotypes of older design in use where a slightly different procedure of changing is necessary. Any magazine to be removed should be in operating position.

To remove the upper magazine, place the locking rod in the magazine to lock the matrices and unlock the catch at

the left of the magazine. Take off the bar which extends across the top side of the magazine. Turn the cam levers forward, and lift the magazine off.

To remove the second magazine: Insert the locking bar in the top and second magazines. Raise the magazines with the elevating mechanism, as high as they will go. Place the frame supports under the upper magazine frame. Remove the bar which extends across the top side of the top magazine. Turn the elevating crank until the frame descends and the second magazine is in operating position, leaving the upper magazine elevated. Place the right- and left-hand cams on the second magazine frame. Lift out the escapements of the upper magazine. Then proceed as in removing the upper magazine.

To remove the third magazine: Remove the two upper magazines and take off the frame cams; take out the eight screws that hold the right- and left-hand gibs to the frame guides; remove the gibs, using care not to get them mixed. Remove the two frames from the guides; take out the two clamps that hold the lower magazine at the rear. Have a helper stand on the frame of the machine in the rear, and reach over the top of the distributor beam to assist in lifting the magazine, while the operator in front gradually raises the magazine clear of the escapement frame. Take out the escapements by removing the two screws in the right-hand support and pry it off, being careful not to bend the dowel pins. Be careful to hold the escapement while removing the support, so it does not drop.

To Remove a Verge. Remove the escapements from the machine and place bottom side up on a bench or table. Push out the pivot rod with another rod of the same size, until you reach the desired verge; release the verge spring; separate the ends of the two rods and lift out the verge and its pawls. Verges are made in various thicknesses and care should be taken that a verge of the same thickness is used in replacing. Examine the verge and pawl to see that there is nothing to retard their free action. Examine the verge spring for wear at the point of contact with the verge. If the verge does not work freely the matrices can not drop properly.

Cleaning a Magazine. To clean a magazine, run out all the matrices into a galley and place the magazine in a convenient place for cleaning. With a good magazine brush, clean all dirt and gum from the inside of the magazine. If the magazine is very dirty, first use a little good gasoline or denatured alcohol on the brush to cut all the gum loose. Brush the magazine and use the air hose or bellows until dry on the inside. Then polish the inside by applying a very small amount of graphite on the brush and rubbing briskly.

In cleaning a magazine, be sure that all the little dark spots which show where the lugs of the matrices set in the magazine, are removed. These spots are gum which forms in the magazine, due to oil and dirt which are carried in on the lugs of the matrices. If these spots are not entirely removed it would be better not to clean the magazine at all. When they are merely loosened up by the cleaning, the matrices will be held back and will not drop regularly.

Frequently the bristles of the brush will get caught in the partitions of the magazine and pull out of the brush. These can usually be removed by dragging the edge of a soft pine yard-stick across them. Also a rubber band around the stick sometimes helps.

Keep the various parts of the machine, with which the matrices come in contact, clean and free from oil, and the magazine will not get dirty for some time.

Cleaning Matrices. Matrices to be cleaned should be placed on a flat galley. With an ink eraser remove the gum or dirt from the lugs and the face. Then blow the loose dust off with the air. Place another galley bottom side up over the galley of matrices and turn both galleys and the matrices over. The back lugs and back side of the matrices may then be cleaned the same as the face. When cleaning the casting edge of the matrices, be very careful not to damage the side walls.

SHOP PRACTICE

1. Run out a font of matrices and clean them.

2. Remove and clean a magazine.

3. Shift the magazines so each of the three are brought into operating position, the top one first; then the center; then the bottom one.

4. Replace the center magazine with another.

5. At the machine, study out the different parts that have to do with the shifting of the magazine.

6. Examine several different matrices; note the different combinations cut on the teeth; note the different thicknesses.

QUESTIONS

1. How are the matrices cleaned?

2. Explain how to remove a magazine from the machine.

3. Explain how the magazines are shifted from one position to another on the machine.

4. Describe a matrix.

5. How is a magazine cleaned?

6. How can the hairs that pull out of the magazine brush in cleaning a magazine be removed?

LESSON 5 — ASSEMBLING ELEVATOR

The assembling elevator is held in place on the face plate by the two gibs, one on each side, and by the assembler roll bracket on the lower right-hand side.

The assembling elevator consists of two castings, held together at the bottom by a large screw and dowel pins. (See figure 9.) The two castings carry, as the main parts, the assembler gate (*a* figure 9), the assembler gate spring (*i* figure 9), retaining pawls (*b1* and *b2* figure 9), the duplex rails (*c1* and *c2* figure 9), the buffer parts on which the matrices strike, the releasing pin (*d* figure 9), and the latch (*e* figure 9).

The matrices, when falling from the magazines, are guided downward by a series of flexible partitions. (See figure 10.) These partitions are thin strips fastened to the assembler plate and are bent at an angle at the bottom to cause the matrix to drop flat on an endless conveyor belt (*a* figure 10) which carries it to the assembler rails (*b* figure 10). These rails are so shaped that the matrices slide between them and the chute spring (*c* figure 10) into the assembling elevator and are moved forward into the elevator by a star wheel.

As the matrix is caught by the star wheel, it is pushed between the two assembling elevator rail pawls (*b1* and *b2* figure 9) and seated on the elevator buffers. The matrix is held in place at the bottom of the elevator by two detaining plates. When these parts are in perfect condition, the matrix will set straight in the elevator.

The back buffer is made of steel, and sets flush with the edge of the back rail of the elevator. The front buffer receives most of the impact of the matrices and there is not much wear to the back one, unless the front buffer is badly worn. The back buffer may be renewed if necessary.

The front buffer is a removable fiber plate set in the bottom and flush with the edge of the rail. The purpose of this buffer is to prevent wear on the bottom lug of the matrix. When the plate is worn, it can be replaced.

The matrix will have a tendency to fall back on the star wheel if the buffer is worn. If the matrices drop very much, a new buffer should be applied.

The detaining plates, at the bottom of the assembling elevator, are for the purpose of keeping the bottom of the

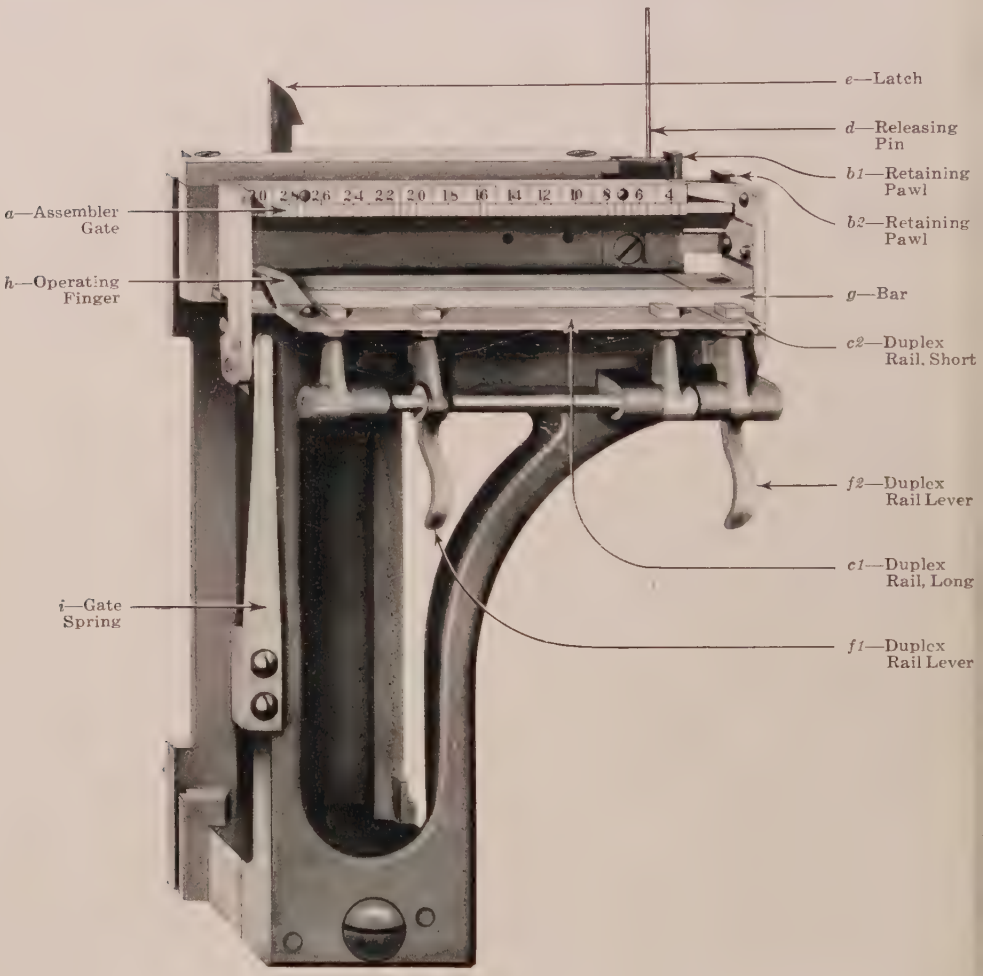


FIGURE 9

The assembling elevator, shown above, answers the same purpose as the compositor's "stick" in hand composition. It is an open casting, having rails upon which the ears of the matrices may rest, and below which the long wedges of the spacebands may hang.

matrix from falling between the assembling elevator and the assembler. These plates must be kept in good condition, and the screws which hold them kept tight, or thin matrices will get in between the elevator and assembler, causing trouble in assembling the line.

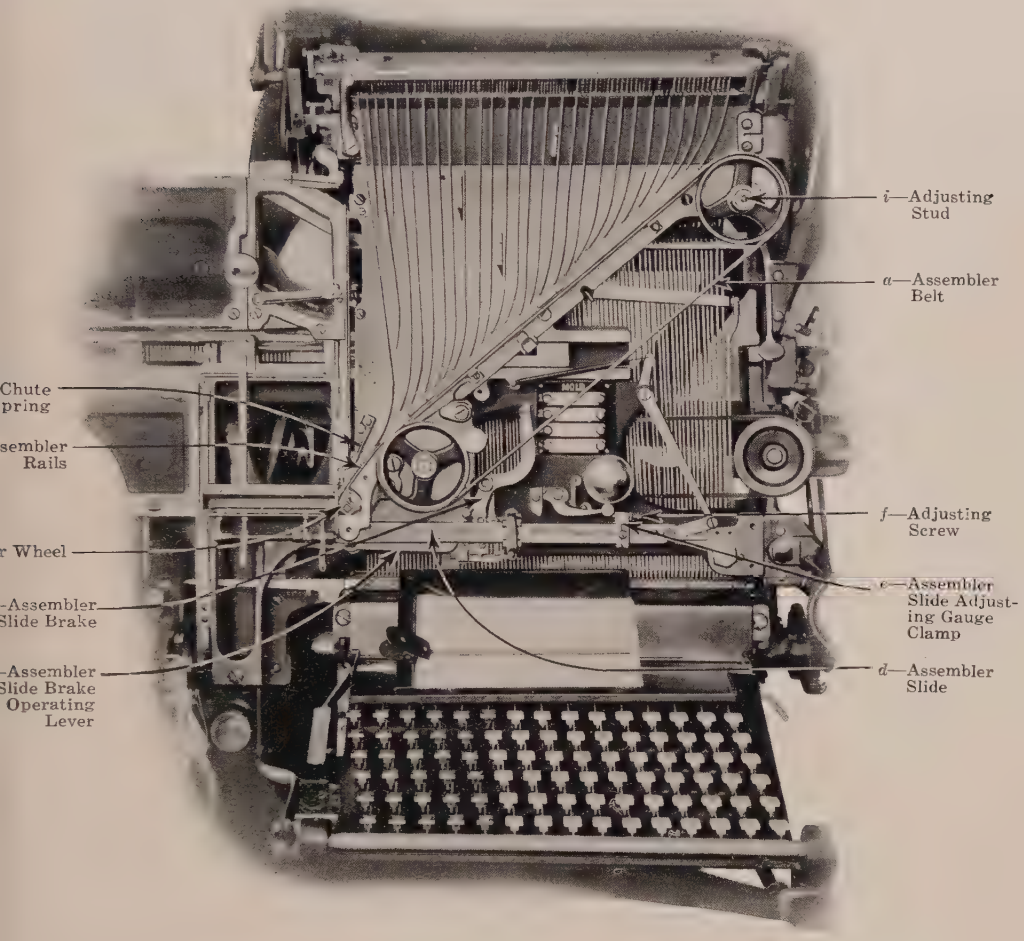


FIGURE 10

When the matrices are released from the magazine they are guided downward by a series of flexible partitions until they drop flat upon a moving belt which carries them forward and under a small spring where they are then delivered upright to the assembler elevator.

Assembled at the right of the assembling elevator back rail and the gate are the two assembling elevator rail pawls (*b1* and *b2* figure 9). These rail pawls are operated by springs, the tension of which should be just strong enough to hold the matrix. The pawls should keep the matrices from falling back on the star wheel.

Most fonts of matrices, up to and including 14-point, have two letters or characters on the casting edge. The characters to be cast must be presented at the proper level in front of the mold slot. To enable the operator to utilize either character instantly, there is assembled in the front of the assembling elevator two thin duplex rails (*c1* and *c2* figure 9). These rails are operated by small levers (*f1* and *f2* figure 9) which permit the operator to assemble the matrices on the upper or lower rail, or mix the line, part upper and part lower. Rails are carried throughout the entire mechanism to hold the matrices at the proper level until after the cast is made.

The rails are assembled on the levers and are held to position by a bar (*g* figure 9) which is fastened to the elevator. A liner on each end, under the bar, gives room for the rails to move without binding. Under the rails are small spiral springs which force the rails up against the bar to keep them from moving too freely when a line is being assembled.

The long rail has a projection out from the base that holds the line of matrices as it transfers from the elevator to the delivery channel. This projection must fit into a groove in the elevator. If this point becomes bent it will not permit the rail to fit, causing bad assembling when in regular position. There is a small operating finger (*h* figure 9) screwed to the long rail that comes in contact with the aligning piece fastened to the delivery channel front rail. This is for the purpose of aligning the upper rails on the assembling elevator with the upper delivery channel rails when the line is in the auxiliary position. If the operating finger does not come in contact with the aligning piece and raise it, matrices in auxiliary, or raised position, will not pass into the delivery channel.

To operate the duplex rails, determine in which position the matrices should be assembled, and press in or pull out on the small levers, as desired. The right-hand lever controls the first half-inch of the duplex rails, throwing it in or out. If the rail is in, the matrices are all assembled on the raised or auxiliary position. If the rail is out, the matrices are all assembled on the bottom or regular position.

The left-hand or the long rail fills out the balance of space in the elevator. It is also connected with a small lever, and operates the same as the short rail. The rails can be moved in or out as needed for a line in the regular or auxiliary position, or for a line partly in the regular and partly in the auxiliary position.

On the back of the assembling elevator at the right, resting on an adjusting screw, is the line delivery slide releasing wire pin (*d* figure 9). This pin should release the line delivery slide just as the assembling latch catches when the elevator is raised.

The releasing pin raises the releasing plunger, which in turn raises the delivery pawl, releasing the slide. This carries the assembled line through the delivery channel. The pin should not release the slide until the latch (*e* figure 9), which is found on the back of the assembling elevator, catches on the stop bar. The latch, which is held in place by a shoulder screw and operated by a spring, holds the elevator in raised position until the slide has carried the assembled line into the delivery channel. The latch is then released by the slide as it passes to the left, allowing the elevator to drop of its own weight to the position to receive another line.

If the pin is adjusted so that it will release the pawl before the latch catches, the delivery slide will start to carry the line towards the delivery channel before the latch can hold and part of the line will fall out, because the elevator drops as soon as released. If the pin is adjusted so it will not release the pawl, the delivery slide will not start.

The pin should be adjusted so it will release the delivery pawl at the same time the latch catches on the stop bar. This adjustment is made by raising the elevator to its highest position and with a narrow screwdriver,

adjust to the proper height by turning the adjusting screw on which the pins rest.

There is a counterbalance spring attached to the assembling elevator, underneath the keyboard frame.

To Take Off Assembling Elevator. Remove the two screws which hold the delivery channel; pull it off the dowel pins. Be careful not to bind the indicator rod that extends up into the delivery channel. Disconnect the assembling elevator lever, take out the four screws which hold the left-hand gib, pull the gib off the dowel pins, and remove the elevator.

SHOP PRACTICE

1. Remove the assembling elevator from the machine.
2. Examine the buffer parts and, if worn, replace with new ones.
3. Examine the retaining pawls. See that they are clean and have the same spring tension.
4. Examine the various working parts of the assembling elevator.
5. Examine the detaining plates. Note how they are held in place.
6. Replace the assembling elevator on the machine.
7. Test the adjustment of the releasing pin.

QUESTIONS

1. Explain how the matrices are assembled in the elevator.
2. What prevents matrices from falling back onto the star wheel?
3. What is the purpose of the buffers in the elevator?
4. Explain how matrices are assembled in auxiliary position.
5. What is the function of the small finger which is fastened to the long duplex rail?
6. Explain the adjustment of the releasing pin.
7. Explain how to take off the assembling elevator.
8. What holds the lower lugs of the matrices from sliding back towards the assembler?
9. What releases the assembler elevator latch after the line has been delivered?

LESSON 6 — ASSEMBLER, SLIDE, AND BRAKE

Assembler. As the matrices descend into the assembling elevator they pass between the chute spring and the assembler chute rails (*a* figure 11). The chute spring is bent and adjusted to break the fall of the matrix and tends to throw the bottom of the matrix toward the star wheel. The points of the chute spring (*b* figure 11) should be slightly below horizontal so they will not interfere with the top of the matrix striking beneath the points of the spring, retarding the matrix long enough for the spaceband to transpose. There must be room enough between these points for the spaceband to pass through without binding as it drops from the spaceband chute into the assembling elevator.

The chute spring must be adjusted so it will allow the heaviest matrix in the font, such as the cap "W," to slip through between it and the rails of the assembler without hesitating. This adjustment is approximate; it is sometimes necessary to change it. Adjust by turning the conical thumbscrew (*c* figure 11) which raises or lowers the spring.

The matrix catch spring is fastened to the rear of the assembler plate and projects $\frac{1}{32}$ of an inch through a slot in the plate. The purpose of this spring is to retard the matrix a trifle before it passes onto the star wheel. The catch spring should be adjusted so it does not project more than $\frac{1}{32}$ of an inch from the plate. It must also be in the center of the slot. If it projects more than the distance mentioned it may cause transpositions. If it becomes necessary to adjust or change this spring, the assembler plate must be removed from the machine.

The star wheel (*a* figure 12) is driven by a friction disk (*d* figure 12) and pinion (*b* figure 12). The pinion fits over the small circular brass disk that is screwed onto the star wheel shaft. To hold the pinion on and to cause friction to drive the disk, there is a spring which is held against the pinion by a nut that screws on the shaft. The spring must be just strong enough to force the assembler slide

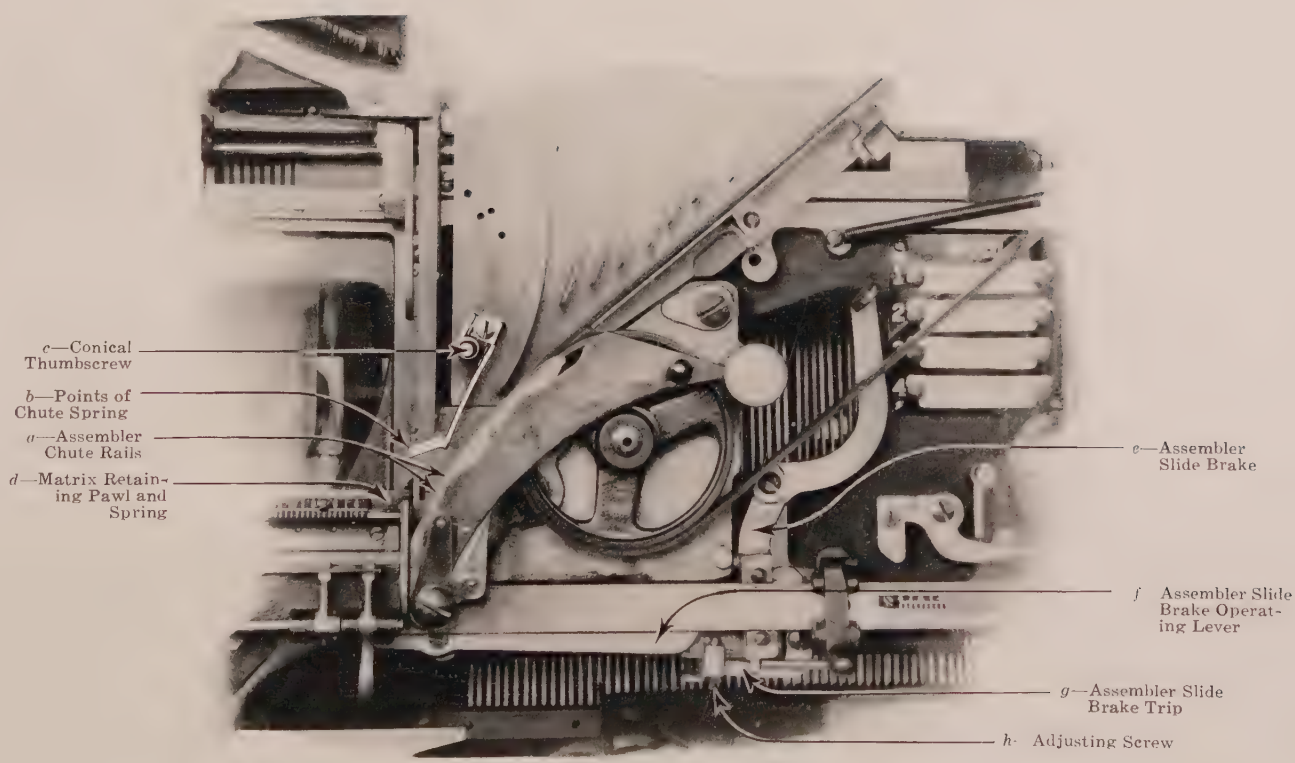


FIGURE 11

Showing how the matrices are restrained at the bottom of the belt by a small spring which may be adjusted for any size matrix by a turn of the thumbscrew.

over when assembling a line, but to allow the star wheel to stop if anything binds it.

If the brass disk wears or becomes oily, or the friction spring becomes weak, a slight resistance to the star wheel will stop it and the matrices will clog in the assembler. If

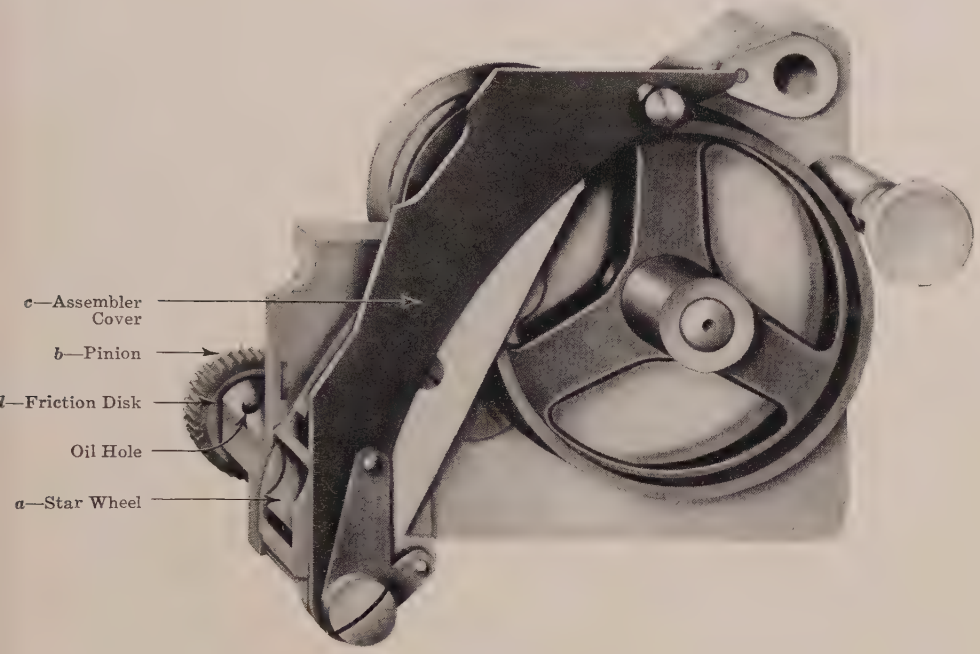


FIGURE 12

This is the Linotype matrix delivery mechanism.

the friction is too strong, the star wheel will not stop when too many matrices are dropped into the assembler. This will cause damage to the matrices or the machine.

If these parts need renewing or cleaning it will be necessary to remove the assembler plate from the machine. This can be accomplished by removing the two screws in the assembler plate, remove the chute spring, release the matrix delivery belt from the pulley at the top, slipping the assembler driving belt off the pulley and lifting the plate off the dowel pins.

By unscrewing the stud nut, the spring and pinion can be lifted off and the disk unscrewed and cleaned or renewed.

The star wheel should force the matrices inside the retaining pawls in the assembling elevator. When it becomes worn to the extent that it will not force the matrices inside the retaining pawls, it should be replaced with a new one.

When renewing a star wheel it is only necessary to remove the small assembler cover, raise the assembling elevator, remove the screw which holds the two chute plates and rails on the dowel pins, and remove the chute plates. The old star can be withdrawn and a new one fitted.

Use a square file to dress out the hole on the new star, but do not have it fitted too loosely. Use care that the star does not bind anywhere.

The assembler chute rails, front and back, are soldered to the plates, and should be kept tightly fastened at all times. The chute rails should be close to, but not dig into, the delivery belt.

The small assembler cover (*c* figure 12) must be adjusted so the matrices do not strike the upper edge while passing to the assembler, as this batters the lugs, and will cause them to stick in the magazine channels. It should also be adjusted so the lower left-hand side sets close to the assembling elevator, to prevent matrices or spacebands from getting between the cover and the assembling elevator.

Assembler Slide. The assembler slide (*d* figure 10) guides the matrices as they are forced into the assembling elevator by the star wheel. This slide is prevented from vibrating by the assembler slide brake.

On the right end of the slide is the gauge and clamp for setting it to the required measure. The gauge is marked in ems and half-ems. By merely changing the clamp the slide can be set to any measure desired.

On top of the clamp is an adjusting screw (*f* figure 10) for the purpose of keeping the slide properly adjusted. The proper adjustment of the slide is determined by inserting a gauge or slug of any known length between the assembler slide finger and the star wheel. The star wheel, being of fiber composition, wears down, which in time will allow enough matrices to be assembled in the assembler to cause a tight line in the vise jaws. By using the adjusting

screw the slide can be kept at proper adjustment. The screw should be turned toward the assembler slide bracket pawl until the gauge stops the star wheel. This is a very important adjustment, as tight lines should not be tolerated on any machine. Tight lines not only ruin the matrices, but they often cause much damage to the machine. They also cause much distributor and escapement trouble on account of the damage done to the matrices.

Assembler Slide Brake. The assembler slide brake (*e* figure 11) is at the right of the assembler, held to the face plate by a screw, and operated by the assembler slide brake operating lever (*f* figure 11), spring, and a trip (*g* figure 11). The purpose of the brake is to prevent the slide from having an unsteady movement when the line is being assembled, so that the last matrix in the elevator will be upright against the star wheel. The brake should hold the assembler slide from returning to normal until released by the operating lever. When the assembling elevator is in normal position it is resting on the top of the assembler slide brake operating lever near the left end, which raises the right, putting the brake in action.

When the assembling elevator is being raised, the lug on the lower right side raises the left end of the operating lever, lowering the right against the adjusting screw in the brake trip which releases the brake, and allows the slide to return to its normal position.

When it is necessary to adjust the brake it can be adjusted with the screw in the brake trip (*h* figure 11), by raising the assembling elevator slowly with the left hand and adjusting with the right so the slide will return just before the line delivery slide is released. There should be about $\frac{1}{64}$ of an inch between the end of the screw on the operating lever, or the trip, and the brake lever when the assembling elevator is all the way down.

There are facing blocks at the point of friction on the assembler slide brake. When these blocks become worn, they may be reversed, bringing another corner to the point of friction.

The left end of the operating lever when raised, should remain so until the assembling elevator has returned to

its proper position. If it does not, when using a long line, the instant the elevator starts to descend, the right end of the operating lever, raising, would allow the brake to go into action, and cause the assembler slide to stop before it has returned to its proper position.

On the back of the operating lever is a friction spring which should overcome the tension of the brake spring, so as to have the left end of the operating lever remain in raised position until returned by the assembling elevator when it returns to normal.

The assembler slide is returned to normal by a long coil spring, as soon as the brake is released. Do not change the tension of this spring if the slide fails to return. The cause of the trouble usually will be found elsewhere.

Matrix Delivery Belt. This belt moves the matrices to the assembling elevator and must be kept fairly tight. It is adjusted by loosening the nut and stud (*i* figure 10) which hold the upper pulley and which fit into a slotted hole; then move the pulley to the desired position and tighten the nut. If the belt is still loose when the stud is against the outer end of the slot a new belt should be applied.

There are always particles of dirt and grease that form a gum which adheres to the pulleys and slideways along which the belt moves. These parts should be kept clean and free of this gum.

SHOP PRACTICE

1. Remove the assembler.
2. Take the friction drive apart and clean.
3. Locate the oil holes in assembler.
4. See that matrix catch spring is in good condition and properly adjusted.
5. Remove and clean the assembler slide and brake.
6. Reassemble the various parts which have been removed.
7. Test the chute spring adjustment.
8. Test the assembler slide adjustment.
9. Test the brake adjustment.
10. See that the delivery belt has the proper tension.

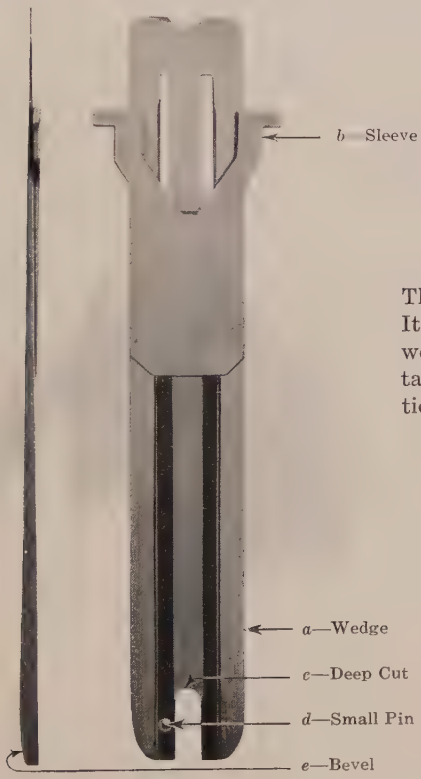
QUESTIONS

1. Why is the star wheel driven by a friction drive?
2. What is the purpose of the matrix catch spring?
3. Explain the purpose and action of the assembler brake.
4. To what position should the chute spring be adjusted?
5. How should the assembler slide be adjusted?
6. Why is the assembler slide adjustment so vitally important?
7. How is the brake adjustment made?
8. How is the assembler delivery belt adjusted?
9. What operates the assembler brake as the line of matrices is being delivered?
10. What is the purpose of the buffers in the assembler?

LESSON 7 — SPACEBANDS AND SPACEBAND BOX

The Spacebands. Spacing and justification are accomplished on the Linotype by means of the spacebands, which are held in the spaceband box above the assembling elevator, into which they drop when the spacebar is touched.

Spacebands are made in two pieces, a long wedge (*a* figure 13) and a sleeve (*b* figure 13), put together in such a manner that they slide freely the one upon the other, but with the outer surface always remaining parallel. The spaceband is thicker at the bottom than at the top, forming a wedge which is automatically driven upward between the



This is a Linotype spaceband. It consists merely of two thin wedge-shaped pieces of metal, tapering in opposite directions so that the outside faces are always parallel.

FIGURE 13

matrices, thus increasing the space between the words, spreading the line to fill the measure, and holding it air-tight during the cast. (See figure 14.)

The sleeve of the spaceband should be turned to the right. Because the casting edge of the spaceband is made slightly thicker than the opposite edge, spacebands must not be reversed in a line, nor two put together; neither should a spaceband be put on the end of a line.

After the cast the matrices and spacebands are carried to the transfer point where the matrices are transferred

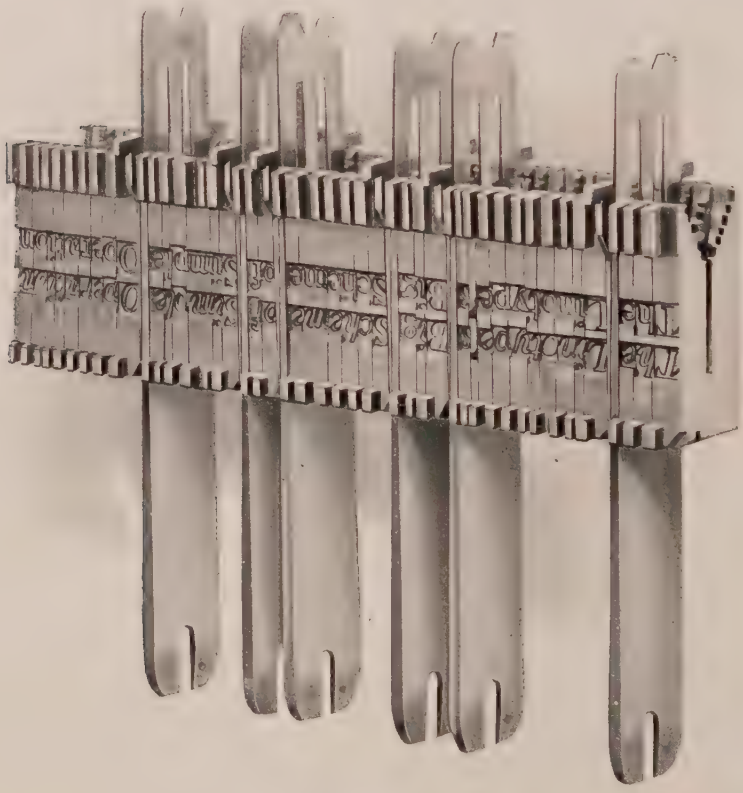


FIGURE 14

This shows a row of matrices and spacebands as they are assembled by the Linotype. The spacebands are driven upward by the justification bar, spreading the line to fill the measure, and holding it air-tight during the cast.

from the first elevator to the bar of the second elevator, while the spacebands, not having combination teeth like the matrices, are left in the channel and are returned to the spaceband box by the spaceband pawl.

The deep cut (*c* figure 13) in the bottom of the spaceband straddles the spaceband buffer finger which guides it in its travels through the assembling elevator and intermediate channel, and lessens the possibility of turning or twisting. The small pin (*d* figure 13) at the bottom of the spaceband prevents it from falling apart.

The bottom of the spaceband (*e* figure 13) is beveled so that it will strike the matrix a glancing, but harmless, blow as it enters the line.

Spacebands which are generally accepted as regular are termed "thick" by the factory. They are also made in other sizes known as "thin," used with very small faces of type; and "extra thick," for the larger faces, or where very wide spacing is desired.

Watch matrices and spacebands carefully, and immediately remove any damaged, bent, or imperfect ones. A damaged matrix or spaceband will damage others, and the whole font may go to ruin within a short time unless the proper attention is given.

Once in each eight hours of operation, the spacebands must be taken from the machine and polished with graphite on a soft pine board. Lay the spaceband flat on its face and rub it briskly backward and forward the long way of the band. Do not rub in a circling movement, as it tends to round the edges. Metal will then cast between the spaceband and the matrix and show in print. The purpose of cleaning is to remove the discoloration or metal adhering at the casting point, and to lubricate the sliding parts. If metal is allowed to accumulate on the spacebands, it will crush the side walls of the matrices when locked up. Use dry graphite in polishing the spacebands. Never handle them with dirty or greasy hands, as the dirt and grease will be transferred to the matrices. If the metal does not rub off, scrape it with a piece of brass rule.

Spaceband Box. The spaceband box is fastened to the face plate by means of a screw and dowel pins.

The spacebands slide down through the box, suspended by their lugs, on two inclined rails (*a* and *b* figure 15). The lower spaceband rests against a raised projection or hook on the inclined rail. The bottom end of the spaceband rests

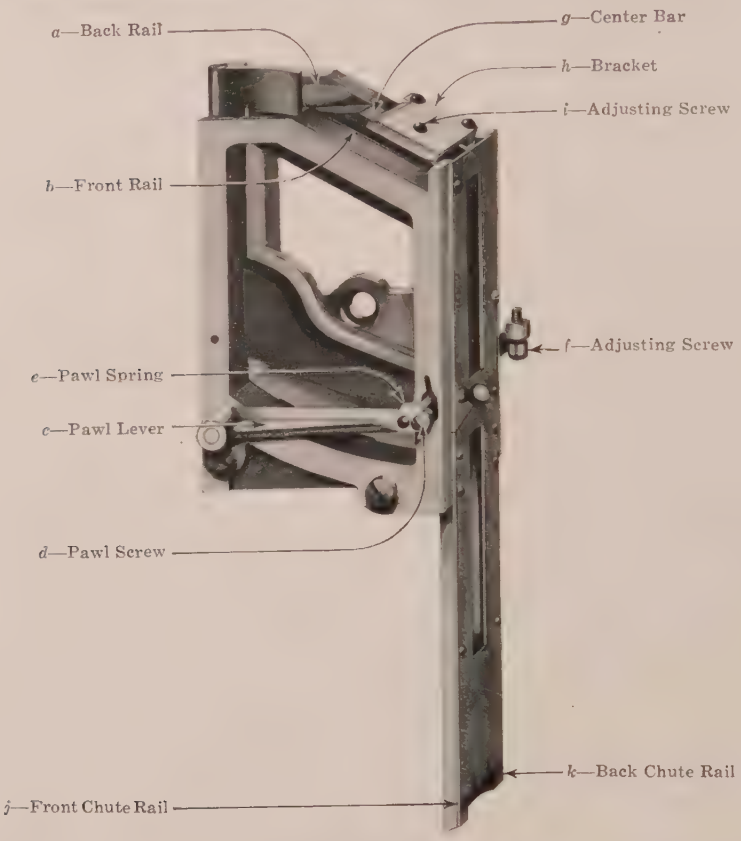


FIGURE 15

This is the Linotype spaceband box, through which the spacebands slide, suspended by their lugs. Escapement is effected by two pawls which lift the spacebands, allowing them to drop into the assembling elevator.

against the chute plate. Escapement of the spaceband is effected by two pawls which lift the spacebands over the rails, allowing them to drop into the assembling elevator.

The pawls are located in the right-hand side of the spaceband box, front and back. These pawls are connected

to the pawl levers (*c* figure 15) by the spaceband pawl lifting screws (*d* figure 15), and held in place by the rails and pawl springs (*e* figure 15). When the pawls are at their lowest position, they are forced under the ears of the spaceband by the pawl springs.

The pawls get their motion in the following manner: When the spaceband key is touched the cam is released and turns the same as the regular keyboard cams. This raises the spaceband key rod against the tension of the spring at the bottom of the key rod. The key rod raises the right-hand end of the spaceband lever. This lowers the left-hand end of the lever, on which the back spaceband box pawl lever adjusting screw rests. This permits the pawls and levers to drop of their own weight. When the key rod cam returns to normal, the spring on the key rod pulls the key rod and the lever to normal, thus raising the pawls and levers by spring action.

The movement of the spaceband box pawls is controlled by the screw (*f* figure 15) in the back pawl lever which rests on the spaceband key lever. When the pawls are at their lowest position, the bottom of the slot in the adjusting screw is resting on the lever. They must go $\frac{1}{32}$ of an inch below the inclined rails on their full down stroke. To make this adjustment, disconnect the keyboard belt from the pulley, touch the spaceband key, turn the rollers by hand until the pawl levers are in their lowest position, disconnect the spaceband lever from the adjusting screw and turn the screw.

The chute plate, against which the lower right side of the spaceband rests while suspended in the spaceband box, must be low enough so that when raised by the pawls, the bottom of the spaceband will be released before the top; if not, it will catch and hang in the box. Whenever it is necessary to make this adjustment, it can be accomplished by bending the chute plate a trifle.

When the first spaceband is being raised by the pawls, the weight of the others being against it would cause the next one to raise by friction unless it were prevented. This is prevented by the center bar (*g* figure 15) which is fastened to a bracket (*h* figure 15) at the top of the box. The

distance from the vertical stop on the box rails to the pins on the center bar should be just enough for one spaceband to raise, the pins holding the second band from raising. By loosening the screw (*i* figure 15) in the bracket and moving the bar, adjust so that the distance from the vertical stop on the rails to the pins is just enough to permit one spaceband to raise, the pins holding the second one. As there are three kinds of spacebands in use—thin, thick, and extra thick—the above adjustment can only be made so as to use one thickness at a time.

The two chute rails (*j* and *k* figure 15) at the bottom of the chute guide the spacebands into the assembling elevator. The spacebands will have a tendency to catch on the assembling elevator rails, and not settle down in the assembler, if the rails are worn. There should be just room enough between the rails for a spaceband to slide without binding.

To Remove Spaceband Box. Push in the controlling lever. Take hold of cam No. 1 and back the cams until the second elevator descends to its safety latch. Hold the spaceband transfer lever with the right hand and press downward with the left hand on the releasing lever in the first elevator top guide. Allow the spaceband transfer lever to move over into the intermediate channel. Push the spacebands back into the channel. Remove the screw on the right-hand side of the electric light bracket and move the bracket to clear the box. Remove the large screw in the center of the box and lift the box off the dowel pins.

In replacing the spaceband box, be careful not to spring the lower end of the spaceband chute. Also be careful not to bend the left ends of the inclined rails.

Spaceband Box Pawls and Rails. The pawls can be removed in the following manner: Remove the spaceband box from the machine, release the tension of the pawl springs by unscrewing the small screw that holds the spring, then take out the pawl screw and lift the pawl out of the box. If the pawls are to be replaced by new ones, select two that are the same height. Test the pawls for height by placing a small wooden plug in the pivot hole of the two pawls. To work well, the pawls must be even as

to height and at the points. If the pawls are rusty or gummy they can be cleaned by rubbing them on crocus cloth and polishing with graphite.

If the pawls are to be examined for wear, mark one pawl when taking them out of the box, so they will not get mixed; for after they have been used, they should be kept in their regular places.

If the spaceband box rails are to be replaced with new ones, the box must be taken apart. Remove the box from the machine. Remove the chute plate. Drive out the taper pin which holds the pawl levers to the lever shaft, and take off the levers. Take out the pawls, unscrew the two large screws, and pry the two castings apart. Take off the center bar plate by removing the two round-head screws. Remove the old rails. Put on the new ones by fitting them on the dowel pins, using care to have the vertical face of the rails even. It is always best to renew the pawls at the same time new rails are put on.

To Replace Spaceband Box Pawls. To replace the spaceband box pawls, loosen the screw which holds the pawl spring to the pawl lever, unscrew the lifting pawl screw, place pawl in the box, screw up on the lifting screw, being careful to guide the screw into the hole in the pawl. Place the spring in the pawl slot before the pawl screw is drawn tight. Tighten the spring screw, which holds the spring against the pawl, until the screw is tight.

The pawl should rest against the back of the pawl guide firmly. Try the pawl to see if the spring has the proper tension and that pawl is not bent so it does not work freely.

SHOP PRACTICE

1. Examine the three sizes of spacebands, noting their relative thickness at various points.

2. Remove a set of spacebands from the machine and clean them.

3. Remove the spaceband box and locate each of the parts shown in figure 15.

4. Remove the spaceband pawls from the box and measure for height of points.

5. Replace the spaceband pawls and test the spring tension and ease of movement of the pawls.

6. Test the adjustment which allows but one spaceband to escape at one time.

7. Replace the spaceband box on the machine.

8. Test the adjustment which regulates the distance the pawls drop when making their full down stroke.

9. Examine the spring which restores the spaceband lever to its normal position.

QUESTIONS

1. Describe the construction of a spaceband.

2. Explain why the spacebands should be turned a certain way in a line.

3. How is a spaceband box removed?

4. How do the spaceband box pawls get their motion to release the spacebands?

5. How are the spaceband pawls adjusted?

6. What prevents more than one spaceband being released at one time?

7. Why is graphite used in cleaning spacebands?

8. Why should spacebands be cleaned regularly?

9. What supports the spacebands as they rest in the box?

10. What trouble would occur if the key rod spring was loose?

LESSON 8 — LINE-DELIVERY SLIDE

The delivery slide consists of two slides (*a* and *b* figure 16) which move in a slideway, a long finger (*c* figure 16), short finger (*d* figure 16), delivery slide rod, and adjusting clamp (*e* figure 16). The slide is connected by a lever link, lever, shaft, and split cam lever, to a roller which operates against the surface of cam No. 10.

The slide gets its action, when delivering a line, from a strong coil spring in the column of the machine which is connected to a lug on the shaft. The slide is returned to normal by cam action, the roller being held against and following the surface of cam No. 10.

When the line-delivery slide is in normal position, it is prevented from sliding into the first elevator jaws by the delivery pawl, which is under the spaceband box, held to the face by a screw, and operated by a spring which holds against the extension on the short finger (*f* figure 16).

This pawl has a notch on the lower side, which acts as a safety to prevent the slide being pulled to the left, in case it is not returned quite far enough for the end of the pawl to pass the catch.

When the slide has returned to normal position, the short finger should go not more than $\frac{1}{16}$ of an inch beyond the end of the pawl. If the finger returns more than this distance, the short finger will be forced against the spaceband box chute and cause it to spring, and very likely cause delay in dropping of the spacebands.

The return adjustment is made by moving the split cam lever in or out. First remove the spaceband box so as to have a clear view of the pawl and finger. Then turn the main cams by hand until just before the high part of cam No. 10 is opposite the split cam lever roller. Place the short finger back of the delivery pawl, in normal position. Hold the lever and roller against the cam and tighten the screws in the split cam lever. This should cause the short finger on the slide to be returned not more than $\frac{1}{16}$ of an inch beyond the pawl.

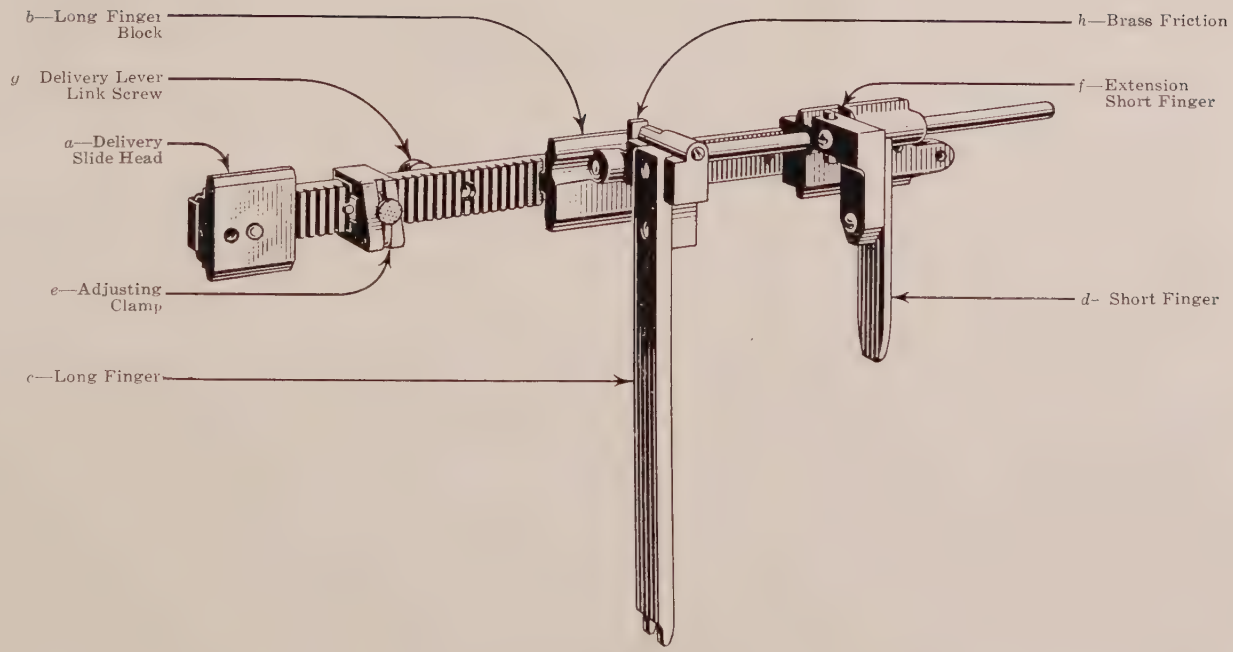


FIGURE 16

This is the line-delivery slide.

This adjustment is approximate, however, due to wear on the connecting part of the slide on machines which have been in use for some time.

Near the right end of the first elevator jaws are two spring pawls which prevent the matrices from falling out while the line is going to casting position. The short finger should stop $^{13}/_{32}$ of an inch inside of the first elevator. The last matrix on the right-hand end of the line will then be inside the two pawls. This adjustment is made by the screw in the slideway (*a* figure 17) on the left end of the face plate, against which the slide comes to a stop.

When the slide stops against the adjusting screw in the slideway, the casting mechanism will be set in action. It is started by the roller on the split cam lever, which comes in contact with the automatic stopping pawl on cam No. 10, forcing it from the upper stopping lever, and the machine goes into action. It should not start before the line-delivery slide has come to a stop against the adjusting screw on the face plate. If it did, the last matrix in the line would not be inside the spring pawls in the first elevator. The plate, which is held to the automatic stopping pawl by a screw on the lower end, is adjustable. Loosening the lower and turning the upper screw to the left will move the plate closer to the split lever or roller and the machine will be set in action sooner; moving the screw to the right, the reverse. This plate should be adjusted so as to knock the automatic stopping pawl off the upper stopping lever not less than $^{1}/_{64}$ of an inch.

The short finger (*d* figure 16) is at the right of the slide and acts as a support for the right end of the matrix line while it is being transferred to the first elevator jaws. There is a small extension (*f* figure 16) at the top of the short finger which engages the delivery and holds the slide in normal position until the assembling elevator is raised to send in a line. The short finger is not adjustable.

The long finger (*c* figure 16) is fastened to the left of the slide. It is the support for the left end of the matrix line while it is being transferred to the vise jaws. The long finger is adjusted by means of the clamp (*e* figure 16). It is necessary to readjust this finger when the measure is

changed. The long finger must be kept straight so it hangs vertically on the machine. If bent either forward or backward it will wear the assembling elevator. If the bottom is bent to the right, it may interfere with the assembler slide,

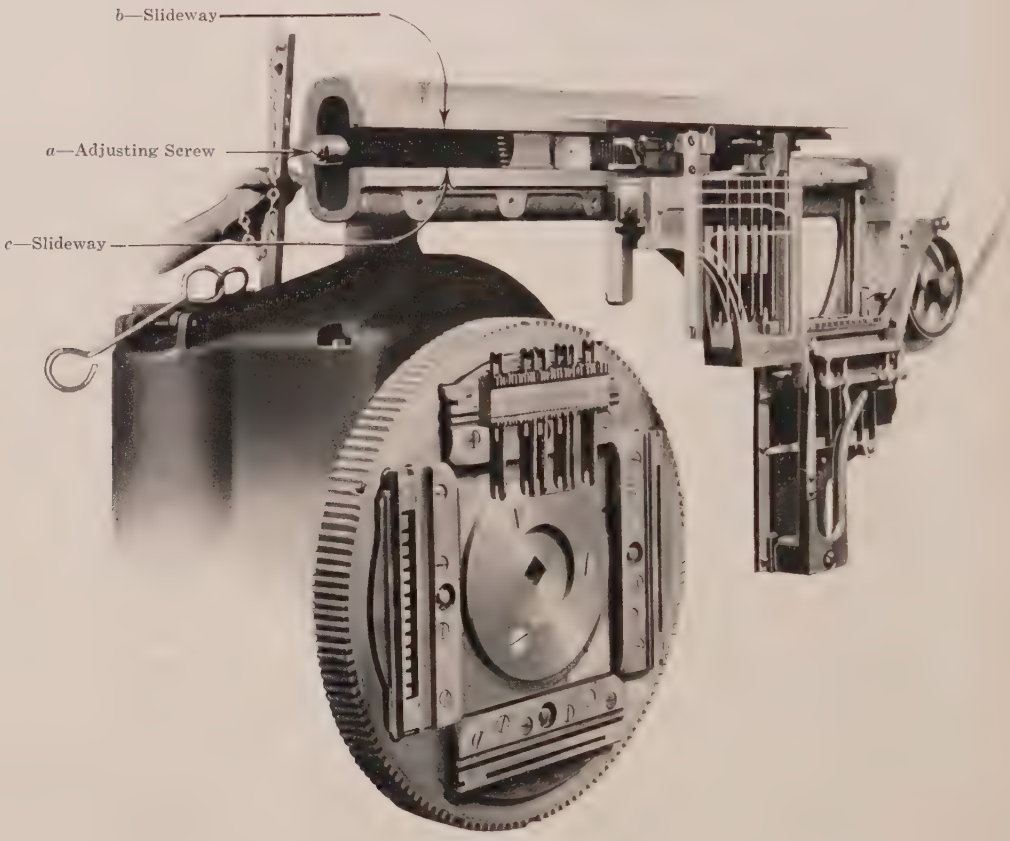


FIGURE 17

This illustration shows the path of the line of matrices and spacebands from the assembling elevator to the casting position.

or the last matrix in the line may not get inside the first elevator jaw pawls, thereby binding the matrix. If bent to the left it will bind full lines of matrices as they are being raised by the assembling elevator and cause the slide to travel slowly. When the slide is returned to normal after delivering a line, the long finger is held against the adjust-

ing clamp by a small brass friction (*h* figure 16) which binds against the slideway. This friction also causes the long finger to rest against the end matrix while the line is being delivered. This prevents the matrices from twisting in the line.

The air chamber, which regulates the speed at which the slide travels, is fastened to the rear of the column. The air cushion piston in the chamber is connected to the split cam lever by a link. As the slide moves over to the left this piston is forced upward into the cylinder. The speed is regulated by an air vent and cover at the top of the cylinder. Opening up the vent allows the air to escape quicker, which in turn allows the slide to move to the left faster. The slide should not go over with too much force or it will have a tendency to loosen the screws in the delivery slide. Do not change the opening in the air vent every time the delivery slide slows up. The cause of a slow delivery slide is usually a lack of lubrication in the slideway.

The lever link, which is the connection between the delivery slide and delivery lever, has a stud which fastens in a depression in the delivery lever and is held by a small plate and two screws. The other end of the lever has a notch that fits over a shoulder screw (*g* figure 16) at the left of the rear side of the delivery slide. The link is held on this screw by means of a long, flat spring. The spring holds the link on the screw except when there is an undue strain on the delivery slide caused by something interfering with the free return of the slide. When the strain becomes too great, the spring permits the link to slip off the shoulder screw, disconnecting the slide from the lever to prevent breakage. To connect the link it is only necessary to relieve the strain on the delivery slide and push the link and the shoulder screw together.

The slideway (*b* and *c* figure 17) should be well lubricated at all times to prevent undue wear on the sliding parts. Dry graphite will give more uniform action than oil on the slideway. If oil has been used on the slideway, it should be thoroughly cleaned before using graphite.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figure 16.

2. Raise the assembling elevator and note how the releasing pin releases the slide.

3. At the machine, trace out the connection of the slide with the roller which operates on cam No. 10.

4. Test the adjustment for the return of the slide after delivering a line.

5. Test the adjustment for the distance the slide travels when delivering a line.

6. Examine the air chamber which controls the speed at which the slide travels.

QUESTIONS

1. What releases the line-delivery slide when a line is sent in?

2. What gives the line-delivery slide its motion when delivering a line?

3. What controls the speed and how is it adjusted?

4. What returns the line-delivery slide to normal position?

5. How is the line-delivery slide adjusted when delivering a line?

6. How is the line-delivery slide adjusted when being returned to normal?

7. What connects the line-delivery slide to the lever which operates it?

8. What happens if the line-delivery slide travels too fast?

9. What care should the slideway receive?

LESSON 9 — METAL POT

The metal pot consists of the pot jacket (*a* figure 18) and pot crucible (*b* figure 18), assembled. The jacket is the outside casting. The crucible fits into the jacket, allowing space between the crucible and jacket for asbestos packing. The crucible is held in place in the jacket by three lugs, which keep it stationary in the jacket. All the space between the crucible and jacket is packed tightly with powdered asbestos which has been mixed with a little water until a paste is formed. This insulation is for the purpose of holding the heat in the crucible.

It is very important that every pot should be well insulated or packed. If there is poor packing the crucible can not hold the heat, the result being poor slugs, and the consequent use of more gas than is necessary. If the machine takes an excessive gas flame to keep the metal in working condition, look for poor insulation; see that the top of the crucible over the mouthpiece is properly packed. Lack of insulation at this point causes a poor face on the slug. In insulating this point, it is necessary to conform to the shape of the mold disk. If the asbestos packing is too thick, it holds the disk away from its regular position and results in an imperfect lockup of the mold and mouthpiece.

The well (*c* figure 18) of the pot, which contains the metal before it is forced through the mouthpiece by the plunger, must have sufficient metal under the plunger to form a perfect slug when a cast is made. For that reason two holes are drilled in the well, one on each side, which allow the metal to enter the well. If the holes become closed, which they sometimes do if the well is not cleaned regularly, the slug will be hollow. They should be kept open, using the end of the mouthpiece wiper, which is bent at a right angle and pointed. The metal pot has a capacity of 38 pounds of metal.

Metal Pot Plunger. The metal is forced by the plunger from the well, through the throat (*d* figure 18) of the crucible, into the mold cell, and up against the line of matrices aligned in front of the mold.

When the machine is in normal position, the plunger should be high enough in the well to permit the metal to run into the well through the holes in the sides. If the plunger does not set above the holes, the metal can not flow

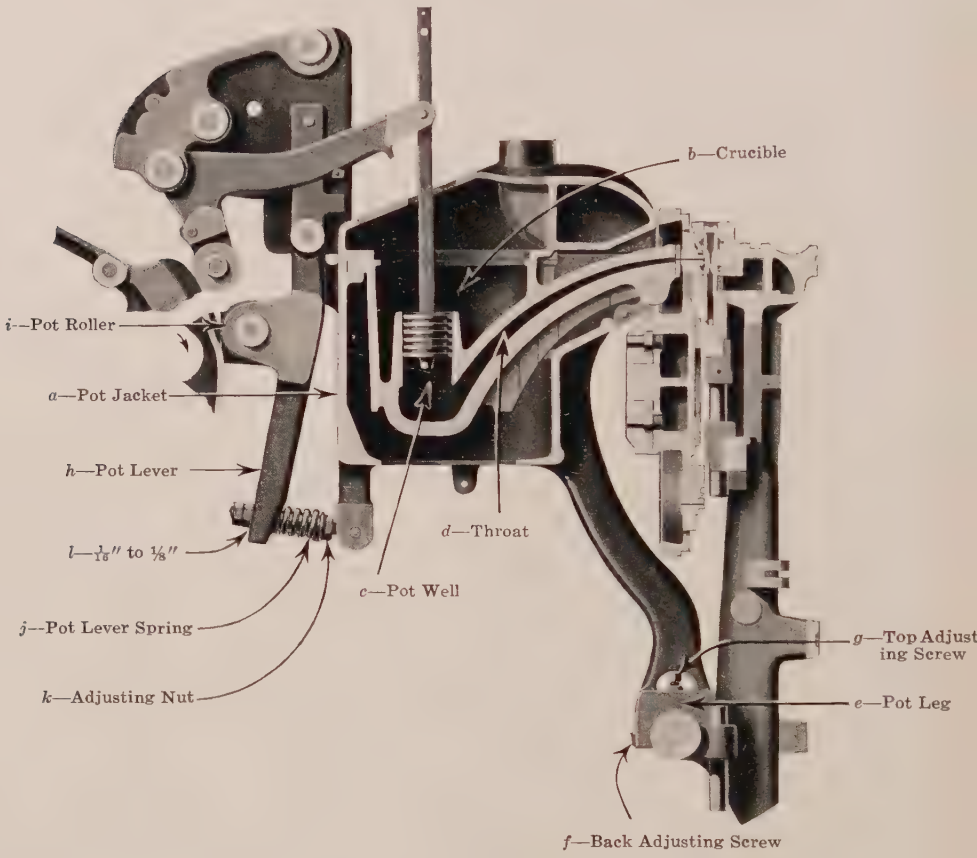


FIGURE 18

This is a cross section of the Linotype metal pot.

into the well and throat, so when the line is cast the slug will appear porous or spongy and of light weight. The position of the plunger can be tested by running a wire hook through the well holes, outside the well. When the hook is inserted, there should be a little play to the plunger before touching the hook.

If a plunger is worn, it will permit the metal to escape around the sides of the plunger when the cast is made, giving a poor slug. To remedy this trouble it is sometimes necessary to put in a new plunger a trifle oversize (.005) and fit it to the well.

A dirty plunger may bind and cause a splash of metal to be ejected before the pot locks up tight, and chilling on the back of the mold, prevent a lockup, so the metal will flow out over the back of the disk when the plunger acts. A dirty plunger will often cause a slug to have the appearance of cold metal. A dirty plunger and well will cause a light, porous slug. Keep the plunger and the well of the pot clean.

Any kind of a wire brush may be used to clean a plunger, but a cleaning box is recommended that will keep the dust confined in the box. There are several kinds of brushes and scrapers manufactured for use in cleaning the well. Use whatever method desired, but be sure it keeps the well clean.

If using a rotary well brush to clean the walls of the well, be sure to turn it always to the right, otherwise the bristles may break off and stay in the well.

If a plunger should stick in the well very tightly, raise the temperature a little, apply a wrench to the plunger rod and twist it carefully. Do not use too much force or the rod may be broken. If a plunger sticks so that it can not be removed by the above method, dip enough metal out of the crucible to expose the well; squirt some oil between the plunger and the inside wall of the well, let it stand for a few minutes, after which the plunger can usually be loosened with the wrench as described. Do not pry up on the plunger for there is danger of breaking the rod.

When the plunger forces the metal through the throat of the crucible, there will be nothing to retard the flow of metal against the face of the matrices if the throat of the crucible is clean. However, if the throat should be stopped up with dross or dirt, retarding the flow of metal, the face of the slug would appear glassy, causing some of the characters not to show up clear, and have the appearance of cold metal.

Cleaning the Throat of Crucible. To eliminate a stoppage in the throat it is sometimes necessary to remove the

mouthpiece and scrape out the throat, using a throat scraper to cut away the accumulation of dirt and dross.

The scraper sold by the Linotype company is recommended for the purpose. Care must be used to get the throat clean. Hold a receptacle that does not leak in front of the crucible mouth and force the plunger down by hand. This will flush the throat of any floating particles of dross.

Sometimes melted tallow, paraffin oil, or machine oil will open up the throat, by being used in the following manner: Dip the metal out of the pot to about an inch below the top of the well, remove the plunger, pour the melted tallow, paraffin oil, or machine oil into the well and replace the plunger. Cast a few blank slugs. After casting about six or seven slugs, fill the metal pot full of metal, recast blank slugs until you have filled the stick. The effect of the tallow or oil is to break up the dross and dirt into such fine particles, that whatever has accumulated in the throat will be forced out through the holes in the mouthpiece. This will cause considerable smoke in the room unless there is a ventilating system. Be sure to clean the vise jaws and mold after the cleaning is finished, for they will be covered with oil. It is not necessary to remove the mouthpiece for this operation so consequently considerable time can be saved. But if the throat is very dirty, this method will not work satisfactorily.

If the plunger and the well are cleaned daily it will eliminate the necessity of cleaning the throat. It is the accumulation of dross that works into the well and then is forced into the throat that clogs the throat of the crucible.

To Remove an Old Crucible. Dip out as much metal as possible, turn out the fire, remove the four pot jacket cover screws, take off the cover, dig out part of the old asbestos, release the screw that clamps the left-hand crucible lug to the jacket, lift out the crucible, clean all of the old asbestos out of the inside of the jacket.

To Put in a New Crucible. The pot jacket should be lined with the asbestos about an inch thick on the inside, except in the front part where the burners are located. Place the crucible in position. Care should be taken to see that it fits firmly in its proper position. Pack the asbestos

around the crucible, tamping it down with a stick, and filling in all the spaces. Cover the well of the crucible with a rag while packing, so that none of the asbestos will get into the well. On completion of the packing place the pot jacket cover in position, and fasten it down firmly with the four pot jacket screws, which extend down through the cover, into the pot jacket.

Mouthpieces. One of the most important parts of the pot crucible, is the mouthpiece. The mouthpiece on all

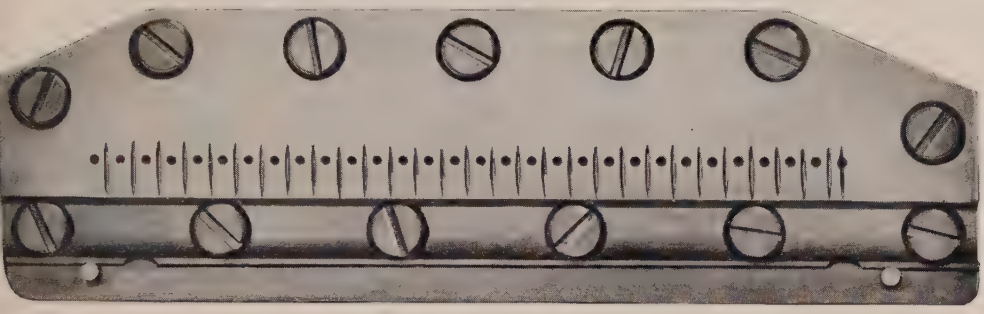


FIGURE 19

This is the part of the Linotype crucible called the mouthpiece. It contains thirty holes through which the metal is forced into the mold cell to form a slug.

standard machines contains thirty holes (size 51), one hole for each pica of the slug, through which the metal flows into the mold cell to form a slug.

The screw mouthpiece is held to the crucible by thirteen screws (figure 19). The screw holes in the mouthpiece are countersunk so the heads of these screws will not extend beyond the face of the mouthpiece.

To remove the mouthpiece from the crucible, use the pot mouth screw loosener obtainable from the Linotype company. Fit the loosener in the groove of the screw and tap the head with a hammer. As the screws will be tight, due to the heat and dross, this tapping will loosen them without damaging the screw heads. The screws can then be removed with a screwdriver. Be sure to clean the mouthpiece of all dross and dirt while it is hot, eliminating the possibility of dross hardening to the steel when cooling.

Before replacing a screw mouthpiece be sure to clean thoroughly the surface of the crucible and the back of the mouthpiece of all dirt and dross. Place a thin coating of red lead and oil or graphite paste on the back of the mouthpiece and place it in position. Tighten the screws gradually, beginning at the ends and working toward the center.

Mouthpiece Vents. On all mouthpieces small cross vents (see figure 19) are cut downward between each of the holes. There is also a vent which is cut from the first hole on the right-hand end of the mouthpiece. The cross vents allow the air to escape from the mold cell as the metal is forced in. These vents play a very important part in the casting of good slugs. If the vents are stopped up with dross or cold metal, the air can not escape from the mold cell. This causes a slug with air bubbles, making a light-weight slug. These air bubbles, when near the face of the type, allow the letters to be crushed in when put under pressure on the press. Also, the entire slug may be forced down, causing much delay in printing.

Care must be taken in cutting the vents in a mouthpiece so they do not extend very far above the top of the holes in the mouthpiece and that they are not too deep. They should be deep in the center and come to a very fine edge at the ends. All that is needed is to get the air out of the mold quickly. Ordinarily this can be accomplished by cleaning the vents with a sharp-pointed scraper, but be careful not to mar the mouthpiece. When the vents are opened properly there should be a sprue of metal below the vents on the back of the mold about ½ to ¾ of an inch long after the slug is cast. A vent that is cut too deep will have too much sprue, causing an unnecessary amount of shavings on the floor and about the machine, and sometimes causing machine troubles. When vents are cut too high they allow a small squirt of metal on the back of the mold on small slugs, because the vent extends above the casting edge of the mold.

Drilling the Holes on a Mouthpiece. It should seldom be necessary to drill out the holes in a mouthpiece. If the metal is properly cared for in remelting, and the mouthpiece is kept at the proper temperature, the metal will usually flow

freely through the holes. However, if it is found necessary to drill out the holes, never use larger than a $\frac{1}{16}$ inch or No. 51 drill, which will not make the holes larger than their original size. When using the drill, it should be immersed in oil after each hole is drilled, to prevent the drill from becoming too hot and breaking off in the hole. Enlarging the mouthpiece holes will work satisfactorily on large faces, 8-point or above; but when the smaller faces are used the product will not have a clear-cut face.

Metal Pot Adjustments. There are two pot leg bushings which fit over the vise frame shaft and project up into the fork of the pot leg (*e* figure 18). These support the metal pot and hold it in position to lock up with the mold. The position of the pot in relation to the mouthpiece is determined by four adjusting screws in each pot leg and bearing against the bushings. Two of these screws can be seen at (*f* and *g* figure 18). These screws permit the proper alignment of the mold and mouthpiece.

The holes in the mouthpiece, through which the metal passes to the mold cell, should align with the smooth or constant side of the slug, as this side of the mold always remains in the same position. When using the mold liners for the different points of thickness of slugs, the position of the mold cap changes. If the holes should align with the rib side of a slug of large size, when changing to a 6-point slug the mold cap would cover the holes, thus shutting off the flow of metal and causing an imperfect lockup or imperfect slugs.

The two screws at the top and bottom of each pot leg (see figure 18) are for the purpose of aligning the holes in the mouthpiece with the constant side of the mold.

To make this adjustment, remove the mold and take it apart. Clean thoroughly the mold and mold pocket. Leave the cap off and place the constant part of the mold back in the pocket with a 30-em left-hand liner and a constant right-hand liner in the mold. Remove the plunger pin for safety. Turn the machine until the first elevator rests on the vise cap. The mold should now be in front of the mouthpiece. Raise the first elevator, holding it up with a piece of wood, one end under the head of the slide and the other

on the upper end of the vise automatic stop rod. Close the vise. Unlock the mold cam lever, move the mold disk forward by hand so the locking studs can enter the bushings. Turn the machine by hand until the mouthpiece advances against the mold. Release the two front adjusting screws a trifle so the pot legs can move freely while making the adjustment. Release the lock nuts and move the top and bottom screws until the bottom of the holes in the mouthpiece are in line with the constant part of the mold, and the two end holes are showing within the liners. Tighten the lock nuts and the front adjusting screws after finishing the adjustment.

A great amount of lockup trouble is caused by the mouthpiece on the metal pot not locking up squarely against the mold, due to the front and back pot leg screws (*f* figure 18) being out of adjustment or the mouthpiece being warped.

To adjust the pot legs so the mouthpiece will lock up squarely with the mold, place the machine and the mold (without the cap) and the 30-em liners in the same position as when adjusting the height, but have the mold cam lever connected to the mold slide. Leave a little space between the mold and the mouthpiece. Place a piece of tissue paper at each end of the mold between the mold and the mouthpiece. Have the paper just inside the ends of the liners. Turn the machine forward until the pump lever is ready to go down for the cast. Be sure the plunger pin has been removed, to prevent forcing the metal out of the pot.

If the left-hand paper should be tight and the right-hand paper loose, loosen the front pot screw at the left and turn in on the back screw. This will move the left end of the mouthpiece farther back. Adjust with the front and back screws in this manner until both papers are held tightly.

After completing the adjustment, replace the cap on the mold and turn the machine to normal position.

Another method of testing the pot lockup is to let the machine make the quarter revolution which brings the mold in front of the mouthpiece. Disconnect the mold lever and pull the mold slide forward. Apply a thin, even coating of a mixture of red lead and oil, or printer's ink, to the back of the mold. Be sure to have the mold clean. Hold out the

mold disk driving pinion, so the disk will not revolve, and let the machine run around without casting. The mixture will transfer from the mold to the mouthpiece. If the mouthpiece is touching only on one end of the mold it can be adjusted by the screws in the sides of the pot legs. Adjust them to swing the crucible to bring about a tight fit, repeating the above test until the transfer is registering evenly the full length of the mouthpiece. After each test wipe off the mouthpiece and mold, for any oil or too much red lead or ink would give a false impression.

If the mouthpiece touches at both ends and not in the center or in the center and not on the ends, it indicates that the mouthpiece is warped and the above adjustments would not be satisfactory.

When the mouthpiece is warped or high, it is necessary to take out the high spots with an oil stone. Take off a very little of the surface at a time and repeat the tests with the red lead until a proper lockup is secured all the way across the mouthpiece.

Pot Lever. The pot lever (*h* figure 18) is located directly back of the metal pot and, through cam No. 8 and the pot cam roller (*i* figure 18), gives the pot its forward and backward action. There is a cushion spring (*j* figure 18) on the pot lever eyebolt that connects the lower end of the pot lever to the pot jacket. This spring gives the lockup of the pot and mold and takes up all excess motion of the lever during the lockup.

There is a short piece of pipe pinned to the eyebolt inside of the spring, which prevents having too much tension on the spring. The nut (*k* figure 18) on the front is the adjusting nut. This nut has a washer next to the spring, to keep the spring from being forced over the head of the nut. This nut should be tight against the pipe. With the end of the rear nut against the pipe on the bolt, there should be $\frac{1}{16}$ to $\frac{1}{8}$ of an inch from the back of the pot lever (*l* figure 18) to the head of the nut when the machine is in casting position. This $\frac{1}{16}$ or $\frac{1}{8}$ of an inch adjustment gives the correct lockup to the pot and also prevents breaking the lever by too much pressure.

The pot lever spring should be examined frequently, as back squirts will be caused by a spring which is broken or worn. This trouble is caused by not giving pressure enough to the mouthpiece when it is being locked against the mold for the cast.

A lever spring weak, worn, or out of adjustment will also cause an uneven height of the matrices, due to the lack of pressure during the cast.

To Remove a Pot Lever Spring. When it is necessary to remove a pot lever spring, pull the pot forward by hand, place a support beneath the pot jacket to hold the pot lever roll off the cam. Remove the pot balancing spring, take off the rear nut on the eyebolt and push back on the lever. The spring can then be removed.

The roller in the pot lever has nine anti-friction roller bearings. These rollers should frequently be examined for wear, and if found worn should be renewed, because a set of worn anti-friction rollers will also cause an imperfect lock-up. When renewing these rollers, put in all nine new ones. If a roller is worn or broken, or the bearing pin or pot lever roller worn, there will be play between the lever and the cam, which will prevent a tight lockup.

To Take Out a Pot Lever. Pull the pot forward by hand, place a support beneath the pot jacket, remove the balancing spring, loosen the screw in the upper shaft bearing, and pull the shaft out. On the upper shaft bearing on each side of the pot lever, are washers of a varying thickness. These washers are for the purpose of adjusting the pot lever sidewise so it will not bind on the main cams. When taking out this shaft be careful that the washers are not lost or mixed.

Take out the wing pin that holds the eyebolt to the pot jacket. Place the lever on the bench and take out roller bearings by releasing the set screw and pulling out the roller pin. Before replacing the bearings, in the lower roller, coat them with vaseline or hard grease. By placing a small piece of an old keyboard rubber roll in the hole, so the bearings fit around it, they will be held in place until the pin is slipped through. The pin will force the rubber out.

Fastened to the back of the pot lever, at the right-hand side, is the pot return cam shoe. As the main cams revolve, the pot return cam, fastened to cam No. 9, comes in contact with the shoe, pulling the pot away from the mold after the slug has been cast.

Removing a Pot. To remove a pot from a machine: Remove the plunger, dip as much metal out of the pot as possible. Lower the first elevator to the vise cap, and let vise down to second position. Remove the mold slide. Take off the pot leg caps. Loosen the front adjusting screws in the pot legs. Loosen the nut on the pot lever eyebolt, to release the spring tension. Take out the pot lever shaft, and remove the pot lever. Take off the mold disk shield and pump stop bracket. The pot can then be lifted out by placing a rope through the supports on the jacket for the pot lever shaft, so that the pot can be raised up while it is being guided out of the machine by taking hold of the bottom of the pot legs.

SHOP PRACTICE

1. At the machine, locate all the parts shown in figure 18 that are visible.
2. With a mouthpiece wiper, locate the two holes in the side of the well.
3. Remove and clean the plunger.
4. Examine the mouthpiece, noting in particular how it is fastened, the holes, and the cross vents.
5. Clean the mouthpiece cross vents.
6. Test the pot adjustments for height.
7. Test the pot adjustments for good lockup, using tissue paper.
8. Test the lockup, using red lead or ink.
9. Examine the pot lever eyebolt, noting the spring action as the machine is running.
10. At the machine, locate the pot return cam shoe.

QUESTIONS

1. Describe the construction of the metal pot.
2. Explain how the metal gets into the well and is forced into the mold.
3. What causes a plunger to stick in the well?
4. How is a stuck plunger removed?
5. Explain two methods of cleaning the throat of a crucible.
6. Explain how to remove a crucible.
7. Explain how to replace a crucible.
8. How should the mouthpiece be cared for?
9. What is the purpose of the cross vents?
10. How can you determine when the cross vents in the mouthpiece are the proper depth?
11. How is a mouthpiece removed?
12. How is a mouthpiece replaced?
13. Explain how to drill out the holes in the mouthpiece.
14. Explain how the metal pot is tested and adjusted for height.
15. Explain how the metal pot is tested and adjusted for alignment.
16. How should a warped mouthpiece be aligned with the mold?
17. Describe the construction of the pot lever eyebolt.
18. What is the purpose of the pot lever cushion spring?
19. How is a pot lever removed?
20. How is the pot lever roller replaced.
21. What pulls the metal pot away from the mold after the slug has been cast?
22. What causes an imperfect lockup between the mouthpiece and the mold?

LESSON 10 — BURNERS, THERMOSTAT, AND GOVERNOR

To obtain best results with the Linotype metal, it should be kept at a temperature of about 535 to 550 degrees F. There are three methods commonly used to heat a metal pot; gasoline burner, gas burner, and electric heater.

Gasoline Burner. The gasoline burner in most cases is undesirable on account of cost, time, and fire hazard; but through the lack of electrical current or gas it must sometimes be used.

There is a burner (see figure 20) designed for either gasoline or kerosene. It will give complete combustion in

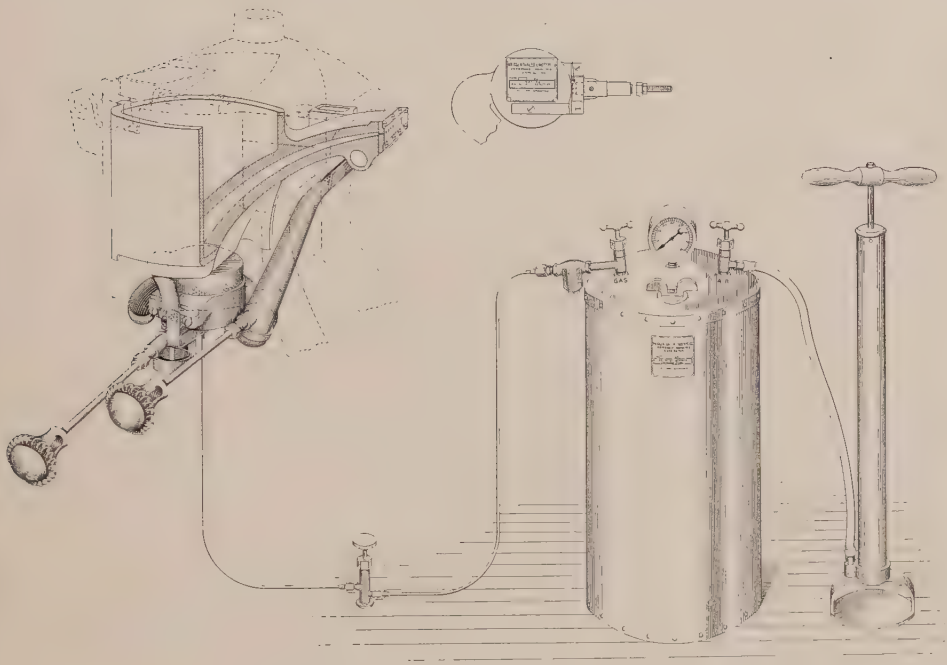


FIGURE 20

When neither gas nor electricity is available, the Linotype gasoline-kerosene burner, as shown above with pressure tank attached, may be used. This burner is adapted to either gasoline or kerosene.

burning either gasoline or kerosene. It has no threaded joints and, therefore, no joints to leak. It is equipped with a positive mouthpiece burner and control. This burner can be taken apart for cleaning without removing any screws. The fuel is forced to the burner from a pressure tank. With this improved mouthpiece burner control, the burner may be adjusted for a slug of any size. The best results can be obtained from a gasoline or kerosene burner by keeping it clean and free from carbon.

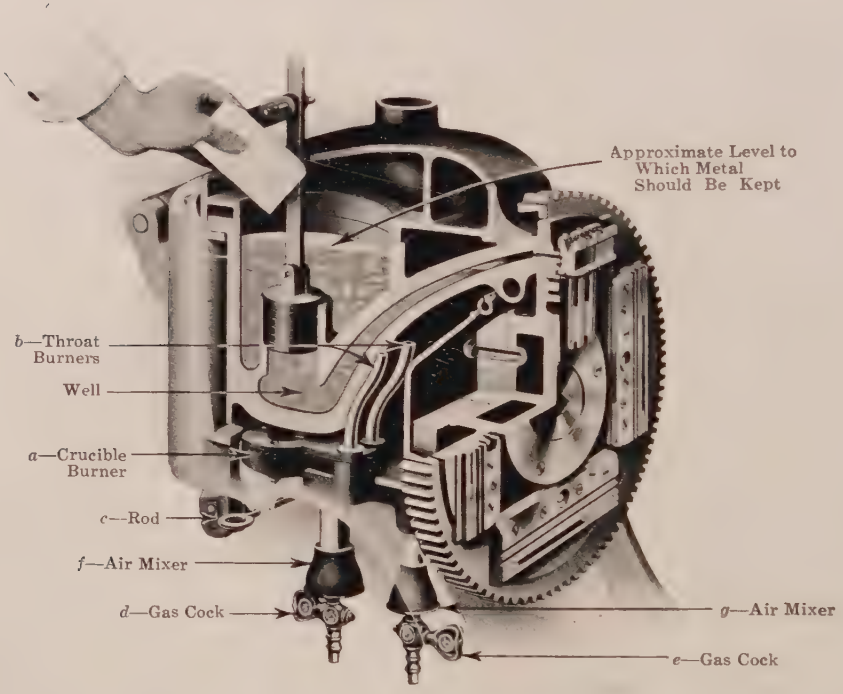


FIGURE 21

This is a cross section of the Linotype metal pot, showing plainly the crucible burner, the gas cocks, and the air mixers. When a line of matrices and spacebands have taken their place in front of the mold disk, the metal pot, as shown above, advances until it touches the back of the mold, then the plunger in the center well is forced down, and the mold and the indented characters in the matrices which close the front of the mold are filled with molten metal.

Gas Burners. The gas burner used to heat the metal pot is made up of three sections. The largest burner (*a* figure 21) heats the main part of the pot. Another pipe leads up to heat the throat (*b* figure 21), and a small burner heats the mouthpiece. The pot and throat burners are held near the pot by a rod (*c* figure 21) which passes through the pot jacket and under the pot burner. The mouthpiece burner is held in place by a support and a screw which extends into the pot jacket.

The gas enters the burners through the pot gas burner cocks (*d* and *e* figure 21). The gas cock that feeds the pot burner has a larger inlet hole than those of the throat or the mouthpiece burners, because more gas is required for the pot burner. The inlet holes must be kept open and free from soot and metal, but should never be drilled larger at any time. Should you find a burner tip that has been drilled, a new tip should be applied by driving out the old tip and inserting a new one.

As the gas leaves the gas cock it passes through the air mixer (*f* and *g* figure 21). The air mixer is open on the bottom side and allows a flow of air to mix with the gas. Unless the gas is mixed with the proper amount of air it will not make sufficient heat under the pot. Do not at any time allow the gas to burn in the mixer. Sometimes when lighting the gas or when the pressure is low the flame may light in the mixer. It should then be turned out and relighted, holding a flame near the burner. Should the gas be allowed to burn in the mixer, the heat will be lost before it reaches the burner; and furthermore, the burner will soon become clogged with soot.

From the mixer, the gas passes upward into the pot burner. The pot burner consists of a circular shaped chamber which is covered with a flat plate. The top rim of the chamber is notched, which allows the gas to flow out around the top plate, forming a very hot flame. The flame from the burner should be of a bluish appearance. A dirty burner will cause a yellow flame. There is very little heat in a yellow flame, and when the burner shows a yellow flame it usually indicates a dirty burner or a fire in the mixer. A very important part of the burner is the top plate. When

this plate becomes warped or badly burned it should be replaced with a new one.

Two pipes lead out from the front end of the pot burner to carry a flame up under the crucible throat. These pipes are fed through the front gas cock. The gas passes through a separate chamber in the front side of the pot burner. It is very essential that these burners are working properly as they keep the metal hot in the throat of the crucible.

The mouthpiece burner consists of a small pipe into which holes have been drilled to allow the gas to escape. This burner extends underneath the mouth of the crucible the full length of the mouthpiece. There are two extra holes on the right-hand end to give a little more flow of gas at that point. The holes should never be reamed out larger, but should be kept clean and free from soot or metal. Metal sometimes gets through the holes and partly fills the pipe. This retards the free flow of gas and causes loss of heat to the mouthpiece.

Good slugs from a machine are to a great extent dependent on good, clean burners. Only experience on various machines will enable one to tell just how much flame to carry in each burner on a machine. The governor should regulate the pot and throat burners, when once adjusted. However, it is better for the operator to regulate the mouthpiece burner with the gas cock, according to the size of the slug being cast.

Gas Pot Hints. Keep gas tips clean and round. A blue flame is the heating flame. Watch the mouthpiece burner. Clean out metal and dross which forms there due to metal dripping from the mouthpiece.

If the mouthpiece burner does not give a long, blue flame after cleaning, procure a new mouthpiece burner and replace the old one.

A yellow flame indicates too little air in the mixture. This can be caused from too large a hole in the gas tip, air inlet partly closed, dirty burners, or gas burning in the mixer. Sometimes the hole in the tip of the gas cock is too large. The hole can be peaned with a small hammer and reamed out with a small broach to the proper size.

The pot burner top plate is fastened by four stove bolts. These bolts become charred and brittle from the heat and the nuts will be very hard to start. Have a few of these bolts on hand when changing the plates, because the plate must fit tightly to the burner to obtain the best results.

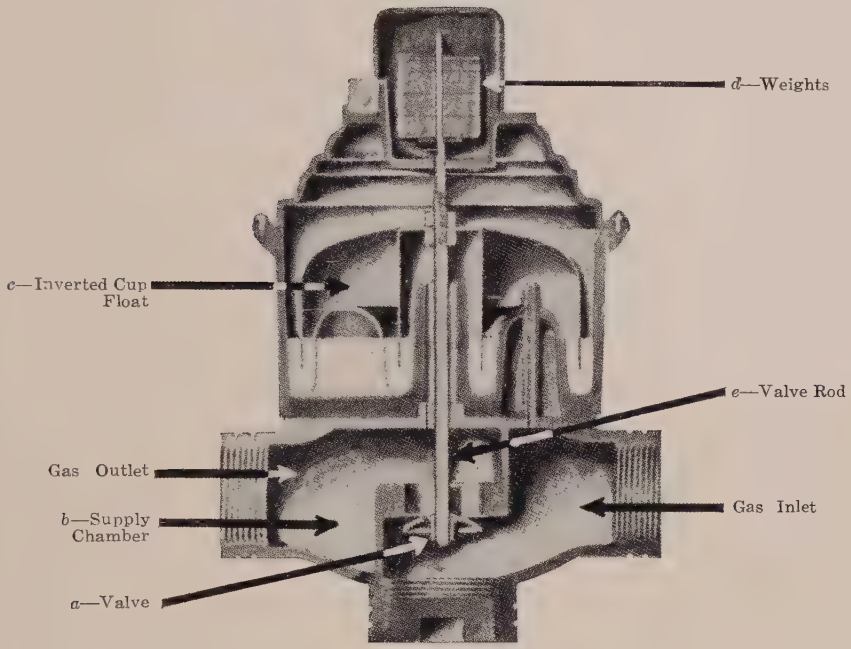


FIGURE 22
This is the gas pressure governor.

Good slugs cannot be produced with dirty burners. Keep them clean.

To Remove the Gas Burners. Disconnect the gas pipe union. Pull out the rod which holds the burners in place and lift them out.

To remove the mouthpiece burner, take out the screw which holds the support to the jacket of the pot, slip the connecting sleeve back, and pull the burner to the left.

Pressure Governor. The pressure governor is used to control the flow of gas to the machine and to keep it at an even pressure. The governor is placed on the main gas line

so the gas must pass through it before flowing to the machine. It is not necessary to have a pressure governor on each machine, for where there is more than one machine, a governor large enough to supply any amount may be secured. The gas enters through a valve (*a* figure 22) in the bottom of the governor and passes up into the supply chamber (*b* figure 22). From the supply chamber the gas flows out to the machine burner. The pressure in the supply chamber is regulated by an inverted cup float (*c* figure 22). The lower rim of the float is immersed in mercury, which causes the cup to float and also acts as a seal to prevent the gas escaping through the top of the governor. Weights (*d* figure 22) are placed on top of the float to counter-balance the gas pressure. Fastened to the float is a rod (*e* figure 22) which passes through the gas chamber. This rod connects to and operates the valve in the inlet opening. When the gas pressure is increased it raises the float by its pressure. When the float raises, it at the same time raises the valve in the intake, which decreases the opening through which the gas enters. Should the pressure in the main fall off, the float sinks deeper into the mercury, and the opening in the valve is opened, permitting a greater flow of gas. Thus the pressure in the gas chamber is held uniform, because the greater the pressure on the float, the smaller the opening for the gas to enter.

To regulate the pressure, place weights on the float until sufficient gas flows to the burners to give a good flame.

Thermostat Gas Governor. The supply of gas at the burners is controlled by the expansion and contraction of rods immersed in the molten metal in the crucible at the left-hand side of the metal pot. These rods are of a special alloy, which is extremely sensitive to variations of heat. No mercury is used, so that the governor is not affected by the pressure of the gas at any time.

The principle upon which the thermostat is built, is the difference in expansion of two metals under heat.

The part of the thermostat (*a* figure 23) which is immersed in the metal is made of cast iron and has a hole or pocket in which the rod (*b* figure 23) of composition metal sets. The upper end pushes against a hinged lever (*c*

figure 23); the other end of this lever operates a valve plunger (*d* figure 23). The expansion of the thermostat rod being greater than cast iron, raises the valve lever, which forces down the valve plunger, seating the plunger nearer the valve seat (*e* figure 23). This cuts down the flow

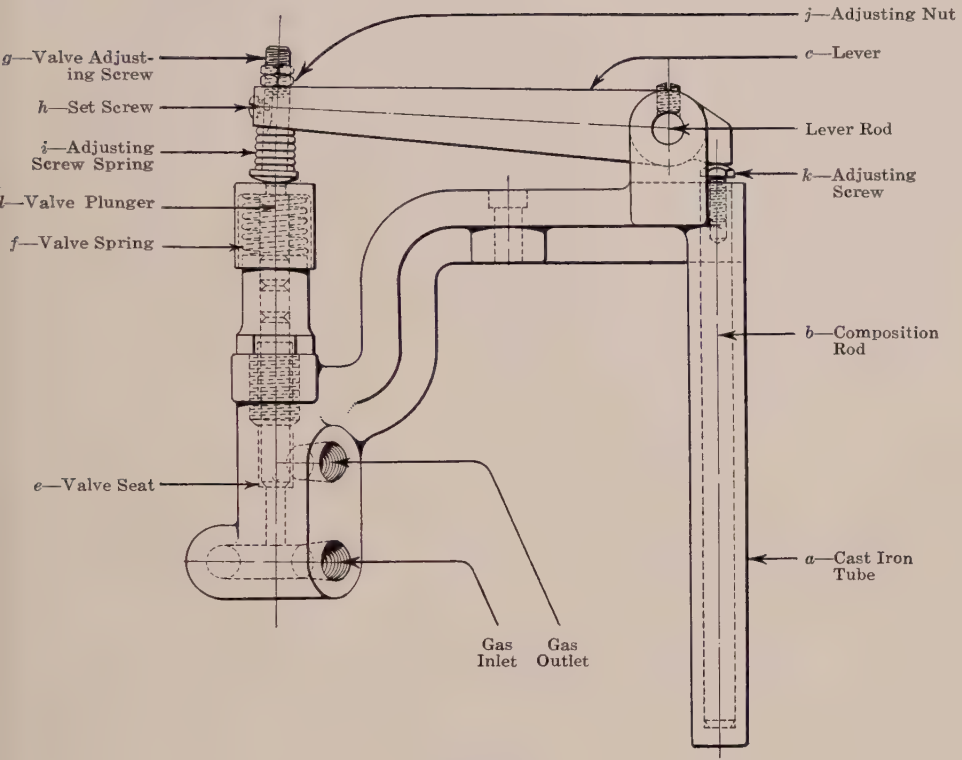


FIGURE 23

This is a thermostat gas governor used to regulate the flow of gas to the burners. It is built upon the principle of the difference in expansion of two metals under heat.

of gas to the burners. The rod contracts as the metal cools, and allows the valve spring to open the valve.

Underneath the valve rod cap and encircling the valve rod, is a spiral spring (*f* figure 23) which raises the valve rod as the expansion rod contracts, which opens the gas inlet, and also keeps the expansion rod pushed to the bottom of the pocket.

In the lower end of the valve is a hole to prevent the burner going out if the valve is entirely closed. This hole must not be enlarged.

The valve adjusting screw (*g* figure 23) is slotted and has a set screw (*h* figure 23) inserted through the valve

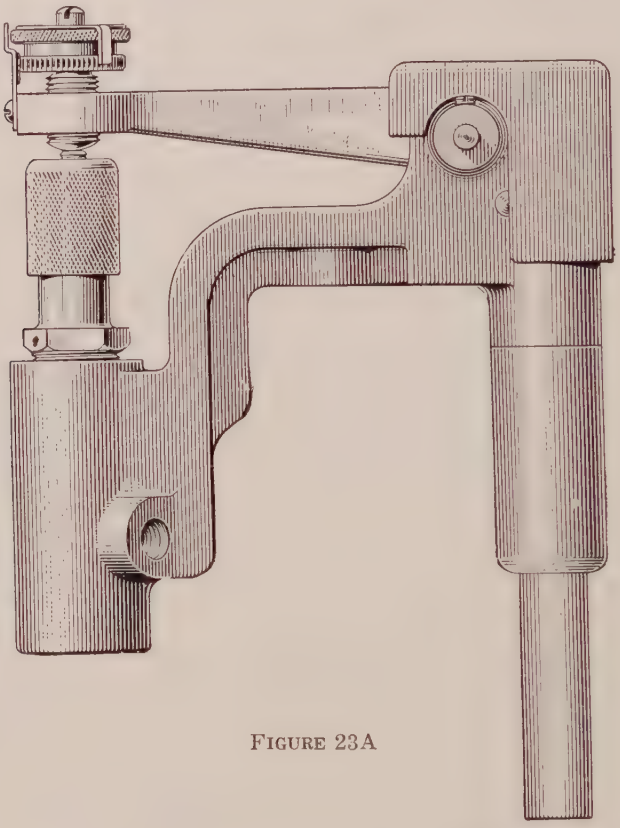


FIGURE 23A

This is a thermostat gas governor of a different type.

lever to keep the adjusting screw from turning. Between the head of the adjusting screw and under part of the lever is a spring (*i* figure 23) which forces the head of the adjusting screw against the cap of the valve. When tightening upon the adjusting nut (*j* figure 23) the spring closes, releasing some of the pressure on the valve, permitting more gas to pass the valve. By loosening the adjusting nut the

spring expands, forcing the valve down, cutting down the flow of gas to the burners.

To adjust thermostat, if metal is not hot enough, raise the adjusting screw by turning the adjusting nut farther down; if the metal is too hot, unscrew adjusting nut, allowing the adjusting screw to force the valve farther down.

The screw (*k* figure 23) in the top of the expansion rod is for the purpose of making the rod longer, should occasion require. Do not change this screw unless necessary.

There are two sets of rods and valves on the regular equipment. One set regulates the gas to the pot burners and the other regulates the gas to the mouthpiece burner. Experience has shown that it is impractical to regulate the mouthpiece from the crucible, so cut off this part of the regulation and use a gas burner cock.

SHOP PRACTICE

1. Remove the gas burner from the machine.

2. Place the burner on a table or bench and locate the various parts shown in figure 21.

3. Remove one of the gas cocks, take it apart and examine the various parts. Note particularly the tip which contains the inlet hole.

4. With an air hose or bellows blow all the soot and dirt out of the various parts of the burner.

5. Examine the mouthpiece burner to make sure it is clean inside and that the holes are open.

6. At the machine, locate as many of the parts as are visible, shown in figure 23.

7. Study figure 23 to determine how the various parts operate to control the pot temperature.

8. Take a pressure governor apart and locate the various parts shown in figure 22.

Note: If no extra pressure governor is available, study figure 22 to determine how the governor operates.

QUESTIONS

1. Describe how the metal is heated in a gas pot.
2. Explain thoroughly the care of the gas burners.
3. What causes a yellow flame in the burners?
4. How should the air mixer be adjusted?
5. Why should the gas cock inlet holes not be enlarged?
6. Explain the action of the pressure governor.
7. How is the pressure governor adjusted?
8. Explain how the thermostat controls the temperature of the metal.
9. How is the thermostat adjusted?
10. How should the mouthpiece burner be regulated?

LESSON 11 — ELECTRIC POT

The electrical equipment consists of four heaters, a dynamic thermometer, and a unit control panel. The passage of electric current through the windings inside the heaters generates heat which melts the metal in the crucible and raises it to the proper operating temperature, while the dynamic thermometer and the magnetic switch on the control panel operate to keep the metal at this predetermined temperature. These equipments are either 100 to 125 volts or 200 to 250 volts, direct current or alternating current.

Before entering into a description of the different parts of the electric pot, the following definitions of the electrical terms are given.

Electric Pot Definitions. The circuit is that part of the equipment such as copper wires, resistance wires, switches, etc., which is intended to carry electric current. They are all insulated from the frame of the pot.

The current is the electricity passing through the equipment.

Ampere is the volume of current passing through.

Volts is the strength or pressure of the current.

A watt is the product of the volts multiplied by the amperes.

A kilowatt is 1,000 watts.

A kilowatt hour is one kilowatt of current used for one hour.

A ground is a bare part of the electric circuit accidentally touching the frame of the pot.

A short circuit is one or more grounds which will allow the current to take a shorter path.

An open is an interruption in the electric circuit such as a broken wire, etc.

Resistance is an obstruction in the electric circuit retarding the flow of current.

Series connection means that two or more units are connected in line with each other. Current enters one terminal,

passes through the windings, out of the other terminal, and directly into the next unit, through its windings, and out to the opposite side of the line.

Parallel or multiple connection means that two or more units are wired in such a way that each makes a complete

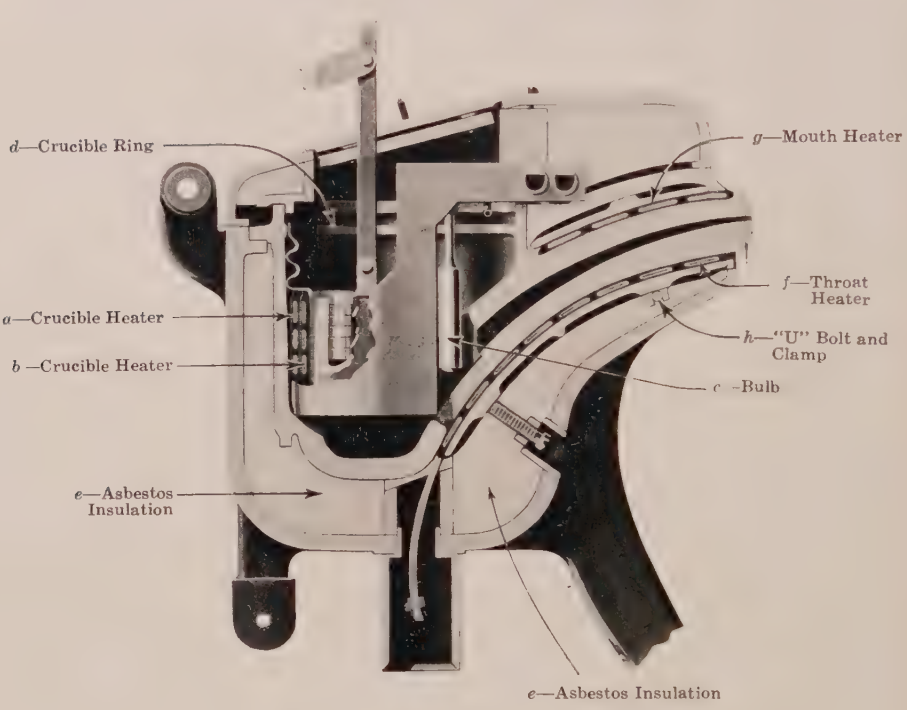


FIGURE 24

This is a cross section of the Linotype electric melting pot.

circuit of itself. Current enters a unit, passing through its windings, and directly back to the line.

Shunt—A conductor joining two points in a circuit and designed to divert part of the current.

An electrical circuit carrying current can best be simply explained by considering an iron pipe through which water is flowing under pressure. The pipe represents the circuit, and water passing through it represents the current. The volume of water flowing represents the amperes, and the pressure of the water represents the volts. A leak which

allows the water to escape represents a short circuit, and a valve in the pipe partially closed represents resistance.

The Crucible Heaters. The crucible heaters (*a* and *b* figure 24) are the same for all voltages; they are connected in "series" for 200-volt to 250-volt circuits, and "parallel"

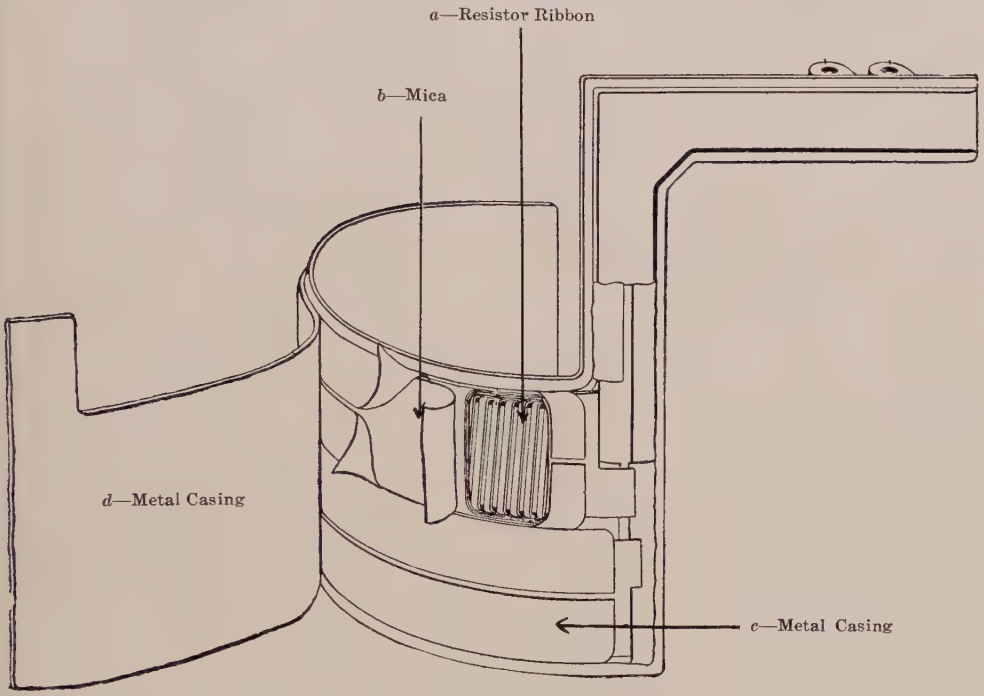


FIGURE 25

This shows a heating element of the crucible heaters, cut open. It shows the resistant ribbon wound on strips of clear mica.

for 100-volt to 125-volt circuits. They are immersed directly in the metal and partially surround the pump-well, heating the metal by direct contact. The heating element or resistor of these heaters is composed of resistant ribbon (*a* figure 25) wound on strips of clear mica (*b* figure 25). Strips of mica entirely surround the resistor, completely insulating it from the metal parts of the casings. The resistors are protected by strong metal casings (*c* and *d* figure 25) which surround them. They are not subject to wear and tear in normal service.

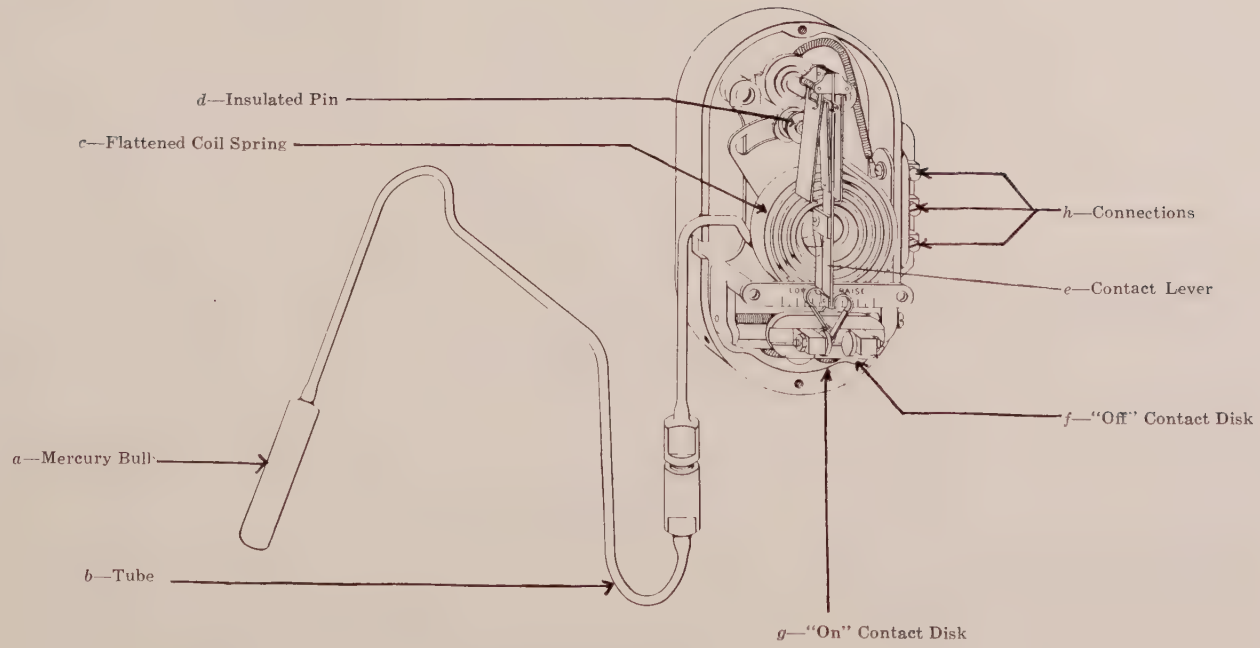


FIGURE 26
This is the dynamic thermometer.

Heating the metal by direct contact from within the metal itself by these heaters, makes a very efficient equipment, as all of the heat generated is immediately transmitted to the metal exactly where it is required, and there is no loss of heat due to faulty conduction. The dynamic thermometer bulb (*c* figure 24) being immersed in the metal adjacent to the heaters and the pump-well, permits of a very close temperature regulation.

As these heaters extend nearly the full height of the metal in the crucible and pass down through the top of the metal, there is no possibility of cracking a crucible. When the metal begins to heat, it is that portion in direct contact with the heaters which first becomes molten. Internal pressure is relieved by this melted pathway and the molten metal will flow to the top of the pot.

It is important that the pot never be filled with metal above the under side of the ring (*d* figure 24) which is cast on the inside of the crucible. If the crucible is filled above this ring, metal may splash over into the heating insulating material and touch the electric terminals, grounding them, or flow over the face of the mouthpiece, giving an imperfect lockup.

The crucible heaters must be entirely covered with metal at all times. If they are not, that portion which is exposed to the air will get very hot and continued exposure will burn them out, destroying them. They are not designed for operation in the air.

Never pry around the units with a screwdriver or pound on them. If the metal envelope is punctured, molten metal will immediately enter, grounding the element and destroying the unit.

The Temperature Control. The temperature in the crucible is controlled by an adjustable dynamic thermometer (figure 26) mounted on the side of the pot, and which operates a switch in the control panel, turning the current on and off as needed. The bulb and tube (*a* and *b* figure 26) of this thermometer contain mercury and the bulb is immersed in the metal at the side of the well of the crucible. (See figure 24.)

The tube is connected to a flattened hollow coiled spring tube (*c* figure 26). The mercury also passes through this air-tight spring tube. On the free end of this coiled spring tube is fastened an insulated pin (*d* figure 26) which operates the contact lever (*e* figure 26). The contact lever is suspended downward between two metal contact disks (*g* and *f* figure 26). These contact disks and the contact lever are connected to the main line (*h* figure 26) through a magnetic switch mounted in the control panel. The contact lever carries current only long enough for the magnetic switch (F figure 27) to connect, and then the current is carried directly through the switch.

As the temperature of the metal rises the mercury in the bulb expands, causing the coiled spring to uncoil slightly, driving the contact lever against the disk that shuts off the current, allowing the switch to fall open and disconnecting the circuit through the crucible heaters.

As the temperature of the metal falls, the mercury in the bulb contracts, allowing the coiled spring to force the contact lever against the disk that turns the current on by connecting the switch to the main line. The variation in the temperature is held within 15 degrees of the average working temperature.

The temperature control is normally set for a maximum of 550 degrees and a minimum of 535 degrees, that is, with normal operation the temperature of the metal will always be between these limits. This is found to give the best all-round casting results for average metal. In case it is desired at any time to change the operating temperature, this can be done by turning adjusting screw right-handed for hotter metal, and left-handed for cooler metal. The head of this adjusting screw projects through the right-hand side of the dynamic thermometer cover.

Do not change the position of the contact disks, unless badly pitted, as their relative distance is determined at the factory, and very seldom need to be changed.

A good thermometer should always be used when adjusting the screw for proper heat. Guessing will not get the proper results.

With ordinary work, and after the metal is at operating temperature, the current will be on and the crucible heaters generating heat about three minutes, then off and not generating heat about twelve minutes, and will repeat this cycle as long as snap switch is left in the "on" position.

Throat and Mouth Heaters. To keep the metal hot while passing out of the pot, two heating units are installed, one extending along the full length of the pot throat on the under side, called the throat heater, and the other above the throat near the end, called the mouth heater. Both heaters are surrounded with heat insulating material and are held in close contact with the throat and mouth by a U-shaped clamp (*h* figure 24) under the throat unit and a plate over the mouth unit, drawn tight by two nuts.

The mouth and throat heaters are always connected in "series," one set being used for 100-volt to 125-volt, and another set for 200-volt to 250-volt.

The heat for the throat and mouth units is controlled by a manually controlled rheostat (*a* figure 27) moving from the left to the right, and fastened to the front of the control panel under and at the rear of the keyboard.

The rheostat is connected directly to the mouth and throat heater and is not controlled by the dynamic thermometer.

The crucible heaters are intended for heating the metal to the proper temperature, and the mouth and throat heaters are only intended to keep the metal at the proper temperature while being forced from the crucible to the mold.

If the voltage is irregular and remains too high for some time, or a speedy operator casts large slugs at a rapid rate continuously, the mouthpiece is apt to become heated and the slugs will have hollow bases. In this case it will be necessary to turn the rheostat knob left-handed, but if the voltage remains low for some length of time, or a slow operator casts small slugs slowly, the mouthpiece may become cold and the slugs will have poor faces, in which case the rheostat knob should be turned right-handed.

When casting large slugs in rapid succession the mold is apt to become heated, but attempting to regulate the temperature of the metal in the crucible to overcome the

heating of the mold will fail, because the electric pot is a heating unit only and will not cool the mold.

The Control Panel. The control panel consists of a magnetic switch (F figure 27) mounted on a slate panel enclosed in a steel cabinet. The cabinet also has a fuse cut-out and

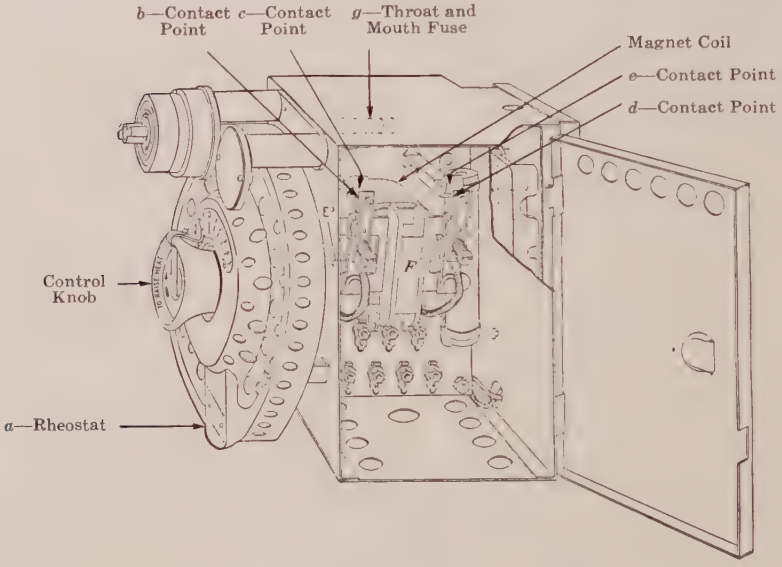


FIGURE 27
This is the electric pot control panel.

the switches which control both the pot and the electric motor (if used) and places all controls within easy reach of the operator. Connection is made between the pot proper, the dynamic thermometer, and the control panel by wiring enclosed in a flexible conduit.

Care of Electric Metal Pot. The contact disks (*f* and *g* figure 26) on the thermometer and the contact points of the magnetic switch (*b*, *c*, *d*, and *e* figure 27) should be kept clean and free from corrosion. Use No. 00 sandpaper. (Never use emery cloth or paper.) Dirt and corrosion are electrical insulators, and if these contacts become dirty, electrical contact may not be made when the temperature reaches 550 degrees F.; the magnetic switch will not open and the crucible heaters will continue to increase the temperature of the

metal until the fuses are blown, the dynamic thermometer permanently injured, or the heating units burned out. When the temperature reaches above 550 degrees, the metal is too hot, causing back squirts. When the metal has cooled, the contacts, due to the dirt, will not operate, and the metal will continue to cool until it can not be used. The contact points should be cleaned about once each two weeks.

When cleaning the contact points on the dynamic thermometer, it is necessary to remove the cover by taking out the two long flat-head screws. This cover should be examined for small particles of metal before replacing.

The hole in the hollow tube connecting the bulb and the flattened coil spring of the dynamic thermometer is very small, and care must be taken that the tube is not injured when feeding metal into the pot, or that no sharp bends are made in it, as it will close the hole and interfere with the proper working of the thermometer.

Occasionally some of the parts, such as the heaters, thermometer, or the wiring inside the pot may become damaged and will have to be replaced. In ordering the new parts for replacements, be sure to specify the voltage being used and the serial number of the pot. This number plate can be found on the top of the pot cover.

It is seldom that both crucible heaters will be burned out at the same time, so if your pot is a 100- to 125-volt equipment, and one of the crucible heaters tests open or grounded, and must be removed and replaced, the metal in the crucible may be heated by the crucible heater that is in good condition; but if your pot is 200- to 250-volt equipment, and one of the crucible heaters must be replaced, it will be necessary to melt the metal in the crucible with a blow torch before either crucible heater can be removed. It is not necessary to remove the metal from the pot. Merely keep the metal agitated while melting.

Frequently a heating unit is burned out by a little metal splashing on the terminals, causing a gradual short circuit. This trouble can be eliminated by wrapping the heater terminals with asbestos tape.

To remove and replace a damaged wire in the pot, fasten another wire securely to one end of it, grasp the other end

with a pair of pliers and pull. The new wire will be pulled in as the old one is removed.

Rubber covered wire or slow burning wire is not satisfactory. A special wire with a special grade of insulation should be used.

If it becomes necessary to remove the dynamic thermometer, heat the metal in the crucible to operating temperature and then turn the main switch off. Disconnect the thermometer wiring and dip out the metal to below the level of the thermometer bulb. Take off the pot cover and remove the two screws fastening the thermometer case to the bracket. Grasp the case with the hand and the bulb with a pair of pliers and raise up and out. Be very careful at all times not to damage or break the bulb or hollow wire which contain the mercury; to do so will cause trouble in regulating the heat.

Replace the thermometer while the crucible is hot. See that the bulb does not project out from the casting so as to interfere with the insertion of ingots of cold metal. Press the tube firmly but carefully into place over the edge of the crucible, being careful not to injure it. Fasten the case to the bracket and reconnect the wiring and put on the cover.

All the pot adjustments on the electric pot are the same as on a gas pot.

Current Consumption. The maximum current consumption is 1,500 watts and the minimum 325 watts, the average consumption throughout a days work is approximately 600 watts, or .6 kilowatts. The cost of current varies widely in different localities, but you may find the cost of operating your pot by multiplying the number of hours by the cost of current per kilowatt hour and then by .6. The result will will be the cost in cents. For instance, operating a pot nine hours with current costing six cents per kilowatt hour, would cost thirty-two and four-tenths cents—9 x 6 x.6 equals 32.4 cents.

Fuses. The main line fuses, which protect the entire system from overloads, when blown, should be replaced by other fuses of the same rating. The fuse (*g* figure 27) for the mouth and throat heater circuit is for the purpose of

protecting this circuit from accidents, and should always be replaced by another fuse of the same rating. This replacing of the fuses by others of the same rating is very important. On a 200- to 250-volt circuit, the main line fuses should be 10 amperes. The mouth and throat fuse, which is located in the control box above the magnetic switch, should be 3 amperes. On a 100- to 125-volt circuit the main line fuses should be 20 amperes. The throat and mouth fuse should be 5 amperes. Fuses of a greater amperage than those mentioned may cause the units to burn out, or cause a fire hazard.

SHOP PRACTICE

1. At the machine, locate the various parts shown in figure 24.

2. Turn off the current and, at the machine, locate the various parts shown in figure 26.

3. With the current off, locate each of the parts shown in figure 25.

4. With the current off, clean the dynamic thermometer contact disks (*f* and *g* figure 26) with 00 sandpaper.

5. With the current off, clean the contact points on magnetic switch.

6. Figure the cost of operating an electric pot for 9 hours at the current rate of cost for electricity.

QUESTIONS

1. Explain how the metal is heated in an electric pot.

2. What controls the temperature of the crucible heaters?

3. What controls the temperature of the mouth and throat heaters?

4. How are the crucible heating units connected for a 110-volt pot?

5. How are the crucible heating units connected for a 220-volt pot?

6. How are the throat and mouthpiece heating units connected on all pots?

7. Why should the crucible heating units always be covered with metal?

8. At what temperature should the metal be kept in an electric pot?

9. What is the average variation in the working temperature of the metal?

10. When the metal is at operating temperature, what proportion of the time is the current on?

11. What care does the electric pot require?

12. Why is it necessary to use fuses on an electric circuit?

LESSON 12 — MOLDS

The various models of machines placed on the market today have a flexibility that requires a variety of molds to take care of the varying lengths and thicknesses of slugs. The molds are adjustable and are all removable from the mold disk should the occasion require. The molds are all

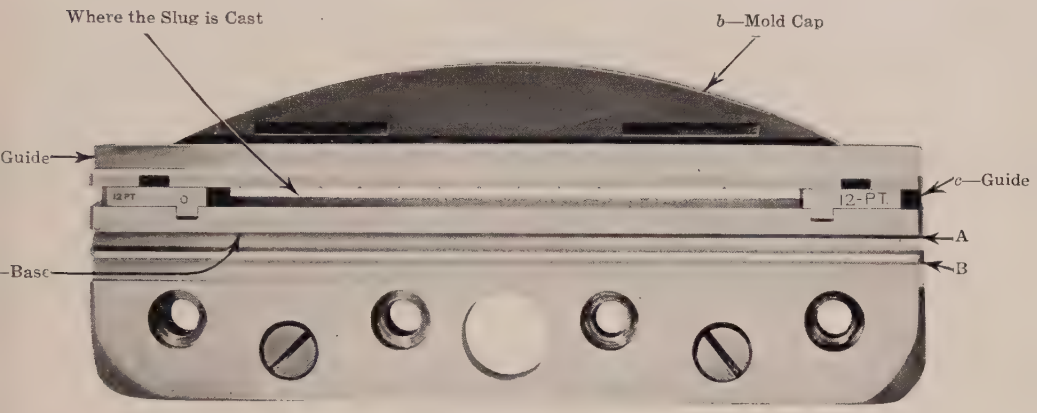


FIGURE 28

This is a Linotype mold. Note the upper and lower rails (A and B at the right) against which the matrices align, to cast in the regular or auxiliary position as predetermined in the assembling elevator.

constructed along the same general line, with a base (*a* figure 28) and movable cap (*b* figure 28). The caps in all molds are held in place by two guides (*c* and *d* figure 28), one pinned on each end of the base of the mold, and projecting into grooves in the cap.

The base of the mold is screwed firmly to the disk, and the two liners are held in place by the cap and the pressure from three screws which project through the rim of the mold disk, the cap and base being held parallel by the guides (*c* and *d* figure 28).

To change the mold from one size of body or length of slug it is only necessary to loosen the three screws, remove the liners and insert the ones desired. Do not pry upward

with a screwdriver inserted in the casting range of the mold cell. When tightening the screws in the rim of the disk, bring them just to a firm bearing. There is danger of cracking the rim if the screws are too tight.

The Universal Adjustable Mold. The universal adjustable mold (figure 28) is the one most generally used. By

FIGURE 29

This shows the mold slot, whose length (and the length of the slug) is determined by the length of this piece of metal, or liner. If the point size of the slug is to be changed, liners *a* and *b* are removed and liners of different thickness are inserted.

removing the liners and substituting others, slugs of any length from 5 to 30 picas and from 5 to 14 points in body may be cast. All standard molds will cast 30-pica slugs.

The right-hand, or constant liner (*b* figure 29), is marked for thickness only. It is not necessary to change this liner unless the slug thickness is changed.

The left-hand liner (*a* figure 29) is marked for thickness and length. The number stamped for the length, subtracted from 30, gives the length of slug which will be cast. For example, if a 13-pica slug is wanted, use liner number 17, which allows the opening in the mold to be the required length. When ordering liners for these molds, always specify thickness and length of slug to be cast; also specify U. A. mold.

The Recessed Mold. In order to cast light-weight slugs and for quick cooling, the recessed mold (figure 30) is made. This mold will cast slugs with cavities or recesses. The base of this mold is the same as the universal adjustable. The lower surface of the cap has rectangular projections and grooves. The molten metal is forced into these grooves

FIGURE 30

The recessed mold, shown above, shows that it is not necessary for the thicker Linotype slugs to be of solid metal.

and forms the supporting ribs beneath the type face. The rectangles form the recesses. The weight of the slug is reduced about one-third. A more solid slug is formed because there is less air to be displaced from the mold. There is less metal in the mold cell, therefore it cools more rapidly than the regular universal adjustable. These molds require special left-hand liners and are adjustable for body size from 10- to 14-point and all measures from 8 to 30 picas. In ordering liners for a recessed mold you must be careful to specify "recessed mold" and the length in picas required. These molds can be applied to any model of machine, but must never be used for any size below 10-point.

Display and Head-letter Mold. The special display and head-letter mold (figure 31) is similar to a recessed mold, but to accommodate the increased size of face, the recesses are deeper. One-letter matrices with the characters for

raised position must be used on this mold. The filling piece under the first elevator jaws must be used when using the mold. Matrices can not be sent in on the duplex rails of the assembling elevator.

Each display mold has a body range of 5 points only, so the entire range of bodies from 15 to 36 points would

FIGURE 31

This shows the display mold for casting extra large slugs.

require four of these molds as follows: The range of one is 15 to 19 points, that is, any width of liner from 15 to 19 points can be used on this mold; the range of the second would be 20 to 24 points, the third would be 26 to 30 points, the fourth, 32 to 36 points. The range of the molds are always marked on the cap so no mistake can be made.

In ordering liners for the display and head-letter molds, care must be taken to specify the range marked on the cap, as well as length of line to be cast.

Advertising. The advertising figure mold differs from the universal adjustable only in the mold cap. The cap is constructed with an extra thick lip (*b* figure 32) against which the overhang in the matrices are cast. This permits of casting large characters which will lap over one or more adjacent slugs. The grooves in the cap are ground parallel. With this mold slugs from 5- to 12-point can be cast, but not above 12-point at any time. This mold can also be used

for casting head-letter type, by letting the letter overhang the slug (*a* and *a* figure 32). Place a blank slug underneath the overhanging letters to support them.

When using the advertising figure equipment, display figures or characters can be cast at any desired point in the line of text matter, the characters or figures casting

FIGURE 32
This shows how slugs with overhanging characters may be cast.

on the first slug against the lip of the mold, thus overhanging one or more other slugs when assembled.

In determining how large a figure may be cast on any size of slug from 5- to 12-point, bear in mind that not over eleven points of the figure may be cast against the lip of the mold cap.

When using the advertising figures, open the knife so the figure will pass through without being trimmed (see figure 33). Leave space on the next line to support the overhang from the first slug. Close the knife so the second slug will be trimmed.

Mold Wipers. There are two felt wipers which are designed to keep the face and back of the mold clean. A small amount of a mixture of cup grease and graphite rubbed into the back wiper will keep the base of the mold clean. For the front mold wiper, keep the felt well saturated with graphite. Do not use oil or grease on the front wiper, or it

will be transferred onto the matrices and into the magazine. A good plan is to soak the felt with gasoline and rub the graphite in. When the felt becomes worn, new ones should be applied. When applying new felt, put graphite between the layers. Be careful that the felt does not become worn to the extent that the steel part of the wipers will be allowed to rub against the mold.

The back mold wiper is found below the back or mold knife, and is held up against the mold disk by springs.

FIGURE 33

This is another illustration of how Linotype slugs may be cast with an overhanging lip which permits large characters to lap over one or more adjacent slugs. The upper section of this illustration shows such a combination, and the lower, the two slugs separated. The mold in which they are cast is shown in Figure 32.

Removing and Replacing Mold. To remove a mold from the disk, loosen the three screws in the rim of the disk, take out the four screws which hold the mold to the disk and lift the mold out of the pocket, being very careful not to drop it.

In replacing a mold in the disk, be sure that all seating surfaces of the mold and disk are clean and free of all metal, so the mold will align with the trimming knives and

mold knife. Then bring the four front screws to a light bearing. Next tighten the three cap screws in the disk, the center one first. Then tighten the four front screws tight.

Never remove the mold keeper from the mold. The mold keeper is for the purpose of holding the lugs of the matrices in alignment. If it is removed and not replaced properly, it will interfere with the proper alignment of every line set.

Cleaning a Mold. The bottom of the mold sometimes becomes tinned. This will not permit the mold and mouthpiece to lock up properly. The trouble can be remedied by removing the mold from the disk and placing it on the bench. Put a small amount of metal polish on a block of hard wood. Rub the wood back and forth the entire length of the bottom of the mold, with an even pressure. As the metal polish contains an abrasive, the mold, cap, and liners should be kept together, so that the casting edge of the mold will not be rounded. Be careful of the molds as they are among the most important parts of the machine and will run indefinitely if handled intelligently.

Take the mold apart and clean the base and cap with the polish. Place each part in a vise so it will be held solid while cleaning. After using polish, clean with gasoline.

Keep the face of the mold clean and free from metal which has a tendency to accumulate during the day while the mold is being used. A clean face on the mold will greatly facilitate the press make-ready. Metal on the face of the mold causes high and low letters on the slug.

SHOP PRACTICE

1. Remove a mold from the machine and locate each of the parts shown in figure 28.

2. Examine the various kinds of molds and note wherein they are different.

3. Examine the back mold wiper, noting its construction and action.

4. Examine the front mold wiper, noting its construction and action.

5. Clean the mold.

6. Replace the mold in the mold disk.

QUESTIONS

1. Explain the construction of a mold.
2. How are liners marked for size of slug to be cast?
3. How does the recessed mold differ from the universal adjustable?
4. How does the display and head-letter mold differ from the universal adjustable?
5. How does the advertising mold differ from the universal adjustable?
6. What care does the mold require?
7. What is the purpose of the mold wipers?
8. What care do the mold wipers require?
9. How is a mold removed from the disk?
10. How is a mold replaced in the disk?

LESSON 13 — THE DISTRIBUTOR

The distributor bar (*a* figure 34) is suspended between the distributor screws, and is fastened to the distributor beam by two machine screws, and held rigid by dowel pins.

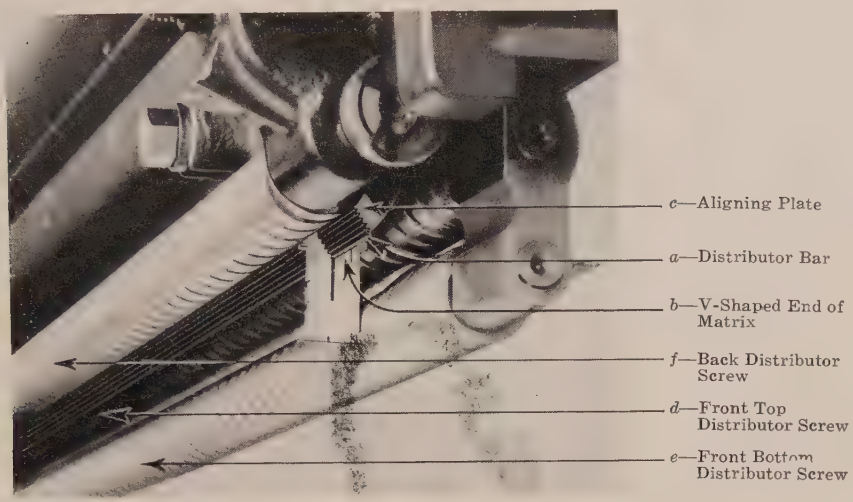


FIGURE 34

This is a close-up view of the matrix clinging by several of its teeth to the distributor bar.

There is a series of seven combination rails on the bar. These combination rails are cut away in various places, and certain of the rails or combinations terminate directly above each channel in the magazine entrance. The V-shaped end of the matrices (*b* figure 34) has combinations or distributing teeth which engage these rails. The bar is adjusted to proper height and position so that the matrices, leaving the top rails of the distributor box, do not bind on the aligning plate (*c* figure 34) at the back of the bar above the rails. These adjusting screws (*a* figure 35) are in the top of the distributor beam and rest on the yoke. The sidewise adjustment is made by an adjusting screw (*b* figure 35)

fastened to the beam and banking against the right side of the yoke. The beam should be adjusted sidewise so the matrices drop between their proper partitions when the distributor is running. When this adjustment is properly made the matrix will just clear the left-hand partition when the

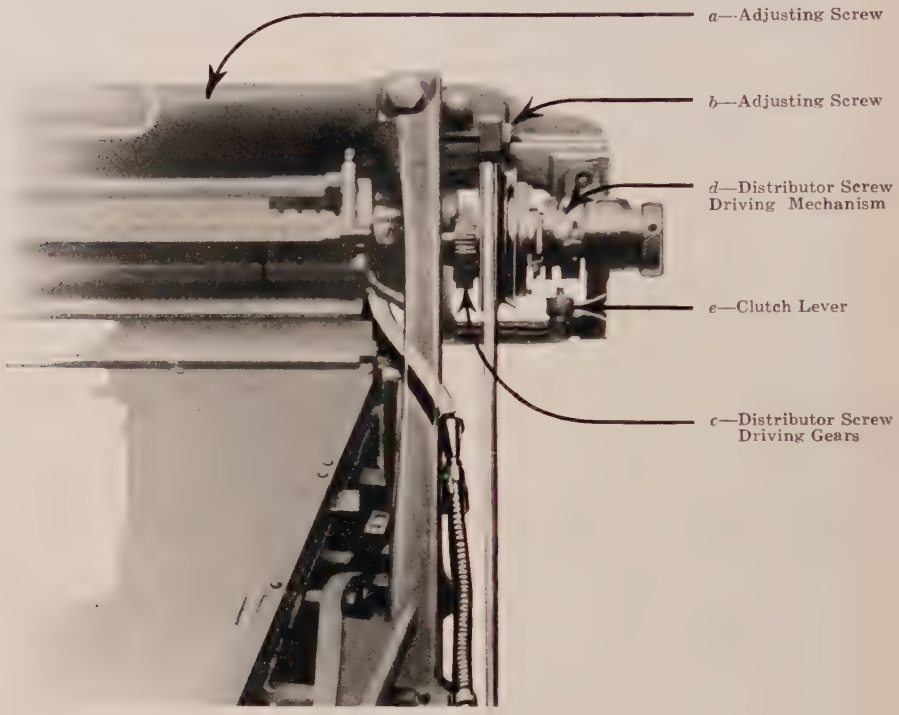


FIGURE 35

This figure shows the adjusting screws and the mechanism which drives the distributor screws.

screws are turned slowly by hand. This adjustment is made at the factory and seldom needs to be changed.

Each matrix has a combination corresponding to the combination rails on the bar. The matrix is conveyed along the bar by the distributor screws. As soon as the matrix reaches the end of the rails corresponding to the combination on the matrix, it drops into the channel entrance (*a* figure 36) which guides it into the magazine.

Channel Entrance. The channel entrance is connected at the rear end of the magazine to the magazine frame by two hinge screws (*b* figure 36). The entrance is held in position by a spring (*c* figure 36) at the left side and fastened to the magazine frame. The channel entrance (*a* figure 36) is equipped with fixed partitions which can not become bent, damaged, or twisted out of adjustment by the action of the distributing mechanism. The channel entrance partitions are thin, allowing large matrices to pass freely through the channels. The partitions are rigid, although thin, because they are supported their entire length.

The partitions have guides at their lower end, which are

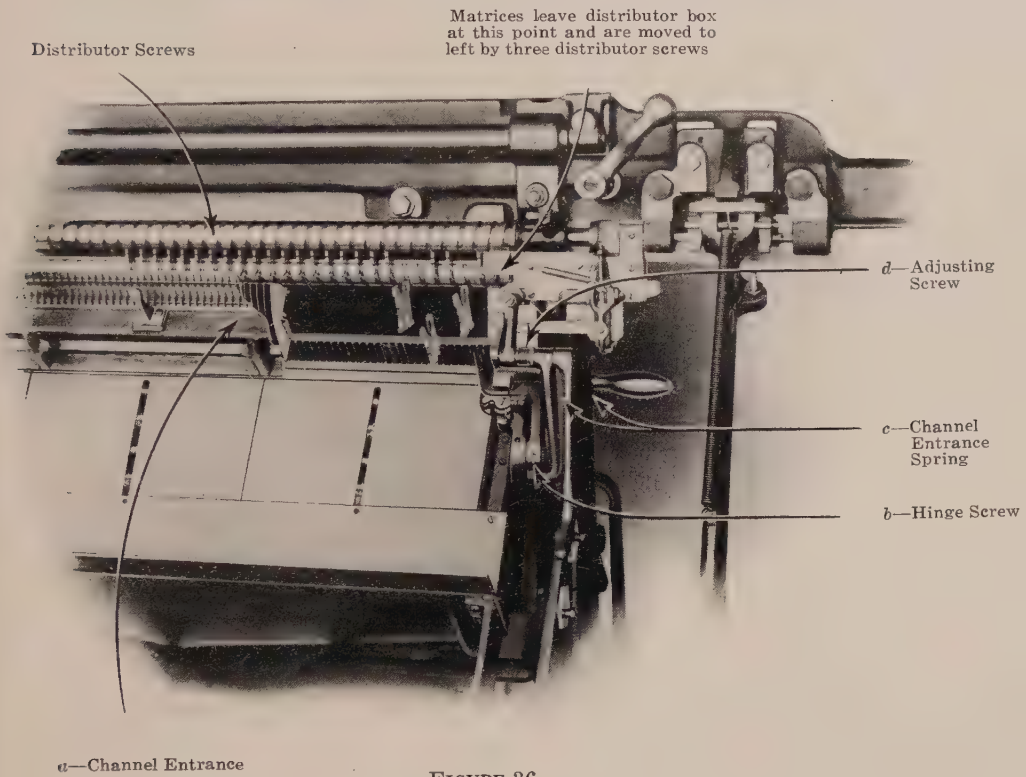

Distributor Screws
Matrices leave distributor box at this point and are moved to left by three distributor screws
d—Adjusting Screw
c—Channel Entrance Spring
b—Hinge Screw
a—Channel Entrance

FIGURE 36

In this illustration is shown how each matrix, after leaving the distributor, is moved along by screws to a point at which the corresponding teeth on the bar are cut away and cease to support it. It then drops at this point into the correct channel of the magazine below.

arranged to direct the various matrices into their respective channels by having contact with the lugs instead of the body of the matrix, giving the minimum amount of friction. At the bottom of the channel entrance, on each side, and banking against the magazine frame, are two adjusting screws (*d* figure 36) which are used to adjust the position of the channel entrance. The adjustment is made to give the matrix free movement in transferring from the channel entrance to the magazine under the channel entrance matrix guard.

As the matrices are carried along the distributor bar by the screws, there should be $^{1}/_{16}$ of an inch between the bottom of a matrix suspended on the distributor bar and the top of the channel entrance partitions. This adjustment is made by the adjusting screws (*a* figure 35) that rest on the yoke. The adjustment is made at the factory, and it is rarely necessary to change it.

Distributor Screws. Assembled on the distributor beam are the distributor screws. Two of these screws are in front of the distributor bar and one in the back. As soon as the matrix leaves the distributor box it is conveyed along the bar.

On the right-hand end of the screws are the driving gears (*c* figure 35) which are pinned to the screw shaft. These gears are properly timed at the factory so as to move the matrix in a vertical position without bending it.

There is a small pin projecting between two of the teeth of one gear which must mesh with a tooth of its companion gear which is partly cut away. This prevents the gears turning when they are improperly timed.

This timing is readily accomplished by forming a small triangle with the pins in the ends of the gears and the openings in the gears, or by placing the points of the upper and lower screws on the right end in the same relative position before connecting the gears with the distributor clutch shaft and gear.

Do not raise the back distributor screw (*f* figure 34) while there are matrices on the bar, as it is difficult to get their lugs in the right threads again.

In closing the back screws, see that the pin in the gear matches with the short tooth in the front gear.

Old distributor screws were pitched four threads to the inch. The new distributor screws have a much wider pitch, two threads to the inch, consequently the matrices are moved along the bar twice as fast to their respective channels. They are called "two-pitch screws."

The two-pitch screws keep the matrices widely separated on the bar, permitting a free distribution of the large matrices.

Keep the distributor screws clean and free from oil at all times. Clean them with a rag on the end of a piece of brass.

Distributor Screw Guard. The distributor screw guard (*a* figure 37) is suspended between the front distributor screws and fits over the lower screw. This guard is for the purpose of deflecting the matrix away from the lower screw as it drops from the combination bar, and also is a safety device when shifting the position of the magazines.

If the magazines were shifted with matrices on the bar, these matrices would drop in the magazine that was in operating position, causing wrong fonts in the magazine. The guard is loose, working on a fulcrum rod, and operated by the distributor screw guard lever and the right-hand magazine locating bar. The lever is fastened to the right-hand magazine frame guide by a fulcrum screw. Whenever the locating levers are shifted for the purpose of raising or lowering the magazine frames, a screw on the right-hand locating lever moves against the guard lever and forces the guard upward. If there are any matrices on the combination bar when attempting to change the position of the magazines, this guard will strike them, and be prevented from making the full stroke. Retarding the bar prevents the locating levers and blocks from moving far enough to clear the bar stops, thus not permitting the magazine frame to be moved.

Distributor Clutch. The distributor screws are driven (*d* figure 35) by a distributor clutch flange, keyed to the distributor clutch shaft and held against the distributor

clutch pulley washer by a spring inside the distributor clutch flange. This spring forces the clutch flange and the clutch pulley washer against the face of the distributor driving pulley. This assembly allows the clutch to slip when anything binds the distributor screws.

The clutch shaft, operated by the distributor clutch flange and clutch pulley washer flange, drives the distribu-

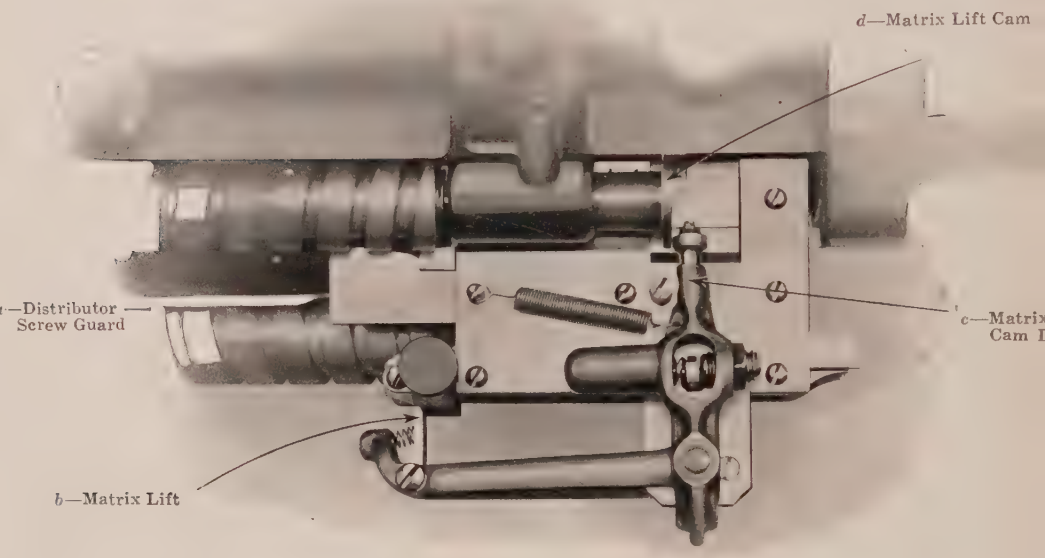


FIGURE 37

This is the distributor box into which the matrices are pushed after being carried upward by the second elevator. The cam causes periodic right-and-left motions of the small vertical arm *c*, this movement then being converted into up-and-down motions of the lifter *b*, which raises the matrices into distributor screws at correctly timed intervals.

tor screws by means of small gears which are timed so that matrices will hang perpendicular from the distributor bar.

Assembled on the distributor clutch pulley washer clutch flange (*a* figure 38) are two distributor clutch stops (*b* figure 38). These are called left-hand stops. Fastened to

the distributor clutch flange are two distributor clutch stops. These are called right-hand stops.

When the distributor is operating, the right-hand stops are held on the left-hand stops by two spiral springs. One end of each spring is fastened to an adjustable spring collar that slips over the distributor clutch flange; the other ends are fastened to the pulley washer clutch flange. These stops force the pulley washer flange against the driving pulley,

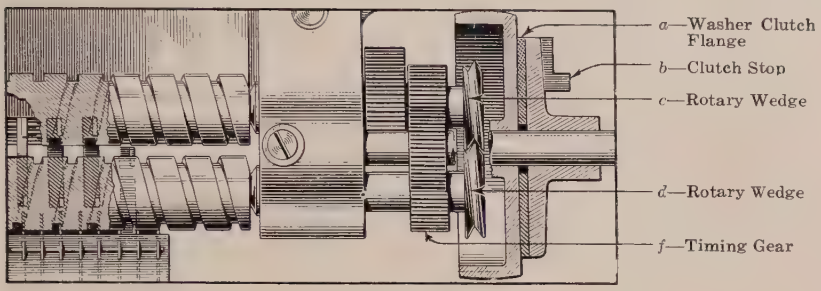


FIGURE 38

This shows the rotary wedges, and the timing gear for the distributor screws.

operating the distributor. The tension of these spiral springs should be just tight enough to hold the stops together.

Two rotary wedges (*d* and *e* figure 38) are pinned to the right end of the two front distributor screw shafts. These wedges are placed so the thin edge of one wedge is opposite the thick edge of the other. These wedges rotate with the screws.

The small timing gear (*f* figure 38) on the lower front distributor screw is loose on the shaft. A connection between the screw and the gear is made by two parallel pins, one on the gear and the other on the wedge. These pins are held together by a spiral spring. The tension of the spring should be so the slightest drag on the lower screw would allow the pins to separate.

When anything binds or retards the revolution of the lower screw, the two parallel pins separate, which changes the relation of the wedges, causing them to lock. This locking of the wedges stops the distributor screws and releases

the tension of the clutch flange on the distributor washer clutch flange, permitting the driving pulley to run free.

When the spiral locks, the tension of the springs should permit the right stops to leave the left, releasing the pressure on the driving pulley.

The tension of these springs can be adjusted by releasing the clamping screw in the spring collar and turning the collar.

The spiral automatic will work when anything binds the lower distributor screw, but for the purpose of stopping the distributor when the channel entrance is opened, there is a clutch lever and screw, assembled (*e* figure 35) which operates when the entrance is opened. This allows the screw to catch the clutch flange collar, forces the clutch flange away from the pulley washer clutch flange, and allows the driving pulley to run free.

To remove the distributor clutch flange and washer clutch flange on a machine with the spiral automatic: Loosen the small screw on the distributor clutch lever, and remove the clutch rod and lever. Remove the two headless screws in the knurled knob on the end of the clutch flange shaft. Remove the hexagon head machine screw that holds the clutch bracket to the distributor beam. Insert a screwdriver between the bracket and the beam at the upper end and pry the bracket away from the beam. Lift the bracket off over the end of the shaft. Remove the flat-head screw in the washer on the end of the clutch flange shaft. Take out the spring which is behind the washer. Take off the clutch flange shaft, stops and springs, assembled. Unscrew the clutch pulley washer flange stop screw. The clutch pulley washer flange can now be removed.

SHOP PRACTICE

1. Open the magazine entrance, raise the back distributor screw, and examine the combination bar.

2. At the machine, locate the various parts shown in figure 35.

3. At the machine, locate the various parts shown in figure 36.

4. Remove the distributor clutch flange, and washer clutch flange, and examine the various parts shown in figure 38.

5. Examine the spiral automatic wedges and distributor screw driving gears to see how they operate.

6. Replace the distributor clutch.

7. Retime the back distributor screw.

8. Send in a line of matrices and observe how they hang on the distributor bar. Note also the distance from the bottom of the matrix to the channel entrance partitions.

9. Clean the distributor screws.

QUESTIONS

1. Describe the construction of the distributor bar.

2. Describe how the matrices are caused to drop in their proper channel.

3. What adjustments are there for the distributor bar?

4. How are the distributor screws driven?

5. What adjustment is there for the channel entrance?

6. What is the purpose of the distributor screw guard?

7. What operates the distributor screw guard?

8. Explain how the spiral automatic stops the distributor.

9. Why should the distributor screws be clean and free from oil?

10. How are the distributor screws cleaned?

LESSON 14 — DISTRIBUTOR BOX

After the line has been transferred from the first elevator jaws to the second elevator bar it is carried by the second elevator lever to the distributor box. When the matrices are being transferred from the second elevator bar

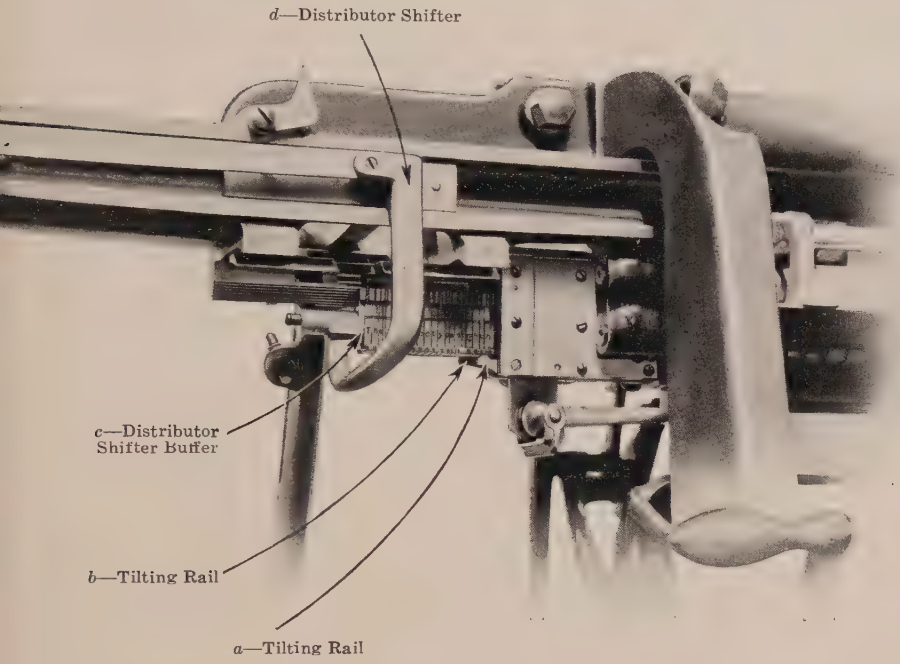


FIGURE 39

The above illustration shows a line of matrices being transferred from the second elevator bar into the distributor box.

to the box bar they are supported at their lower end by the tilting rails (*a* and *b* figure 39). These rails release the strain on the matrix combination, and also prevent matrices falling from the bar if there is any space between the two bars.

To assure a good alignment of the two bars, the box bar pin hole at the left is elongated, allowing play to the bar, which permits the teeth of the second elevator bar to align easily with the box bar.

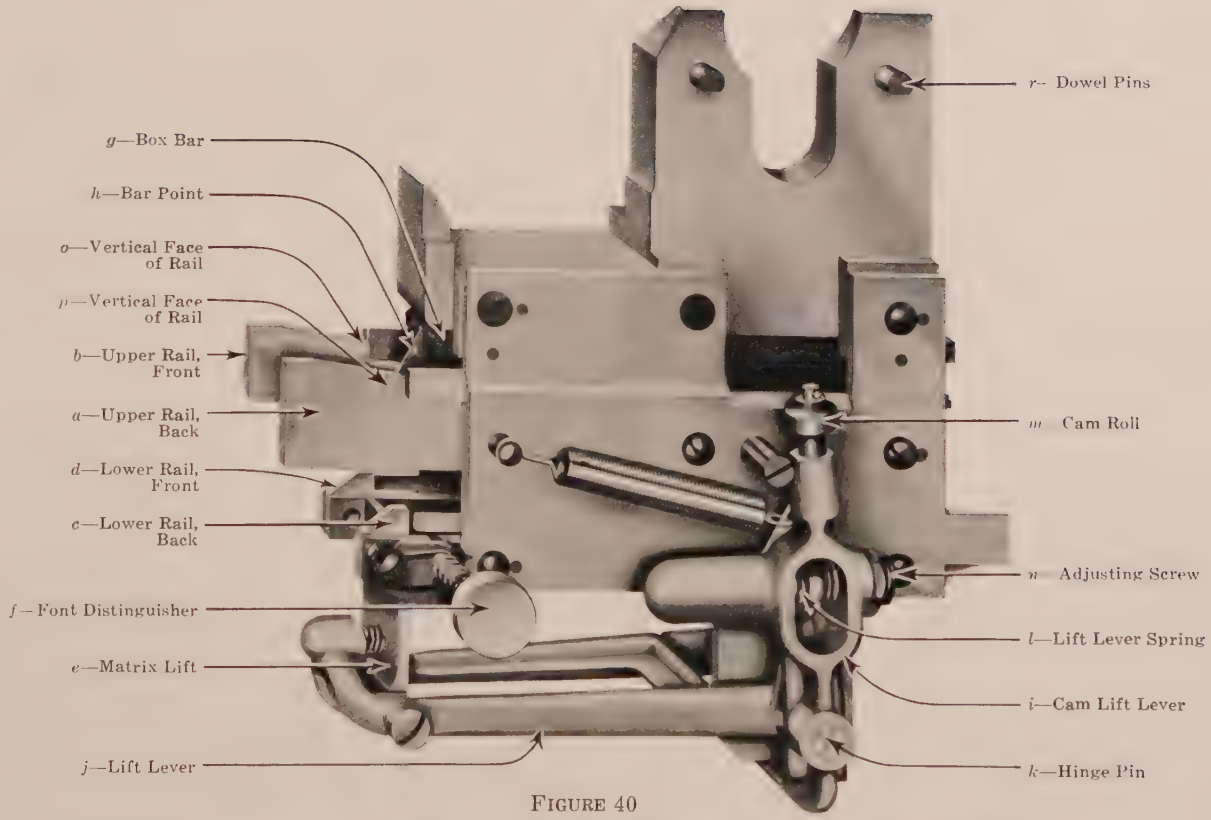


FIGURE 40

This illustration shows the various parts of the Linotype distributor box.

The distributor box contains the upper and lower rails (*a, b, c, d* figure 40), tilting rails, matrix lift (*e* figure 40), font distinguisher, box bar (*g* figure 40), and point (*h* figure 40), assembled, safety spring, lift cam lever (*i* figure 40), lift lever (*j* figure 40), lift hinge pin (*k* figure 40), lift lever spring (*l* figure 40), lift spring, lift cam roll (*m* figure 40), and matrix lift adjusting screw (*n* figure 40).

Matrices, coming into the box, hang to the rails on the box bar by their teeth until they reach the vertical face of the box rails (*o* and *p* figure 40). There are two upper and two lower rails held to the box plates (front and back) by dowel pins and screws, so that the matrix will align perfectly with all four rails and the bar point at the right end of the box.

The rails must align the matrix to clear the distributor screws and the aligning plate on the combination bar without binding. The matrix must also pass between the vertical face of the rails and the bar point (*h* figure 40). If these rails become worn, they will permit more than one thin matrix to pass the bar point, or will not lift the matrix so it will clear the screws properly, because of the unevenness of the vertical face of the rails. This will bend the ears of the matrix and stop the distributor.

The only remedy for worn rails is to apply new ones. Four new rails must be applied, as the vertical faces of all the four rails wear, and this is the only method of obtaining the proper alignment again.

A safety spring is pinned in a grooved part of the upper front rail at the right end to prevent matrices turning and getting caught by the lift when the shifter is suddenly withdrawn. It is only the matrix ready to be lifted that need be held by the spring.

As the matrices are lifted by the matrix lift they must pass between the vertical face on the rails and the bar point. All matrices are the same thickness where they pass this point. There is just sufficient space between the rails and the bar point for but one thin matrix to pass when lifted by the matrix lift. If the bar point becomes worn or broken it will permit more than one thin matrix to be lifted to the

distributor screws, resulting in the clogging of the channel entrance or bending the matrix.

The matrix lift mechanism (see figure 40) is composed of the matrix lift lever, the matrix lift cam lever, matrix lift spring, matrix lift cushion spring, matrix lift hinge pin, matrix lift cam roll, and the matrix lift.

This matrix lift (*e* figure 40) is at the right end of the box and is held to the lift lever by a fulcrum screw and forced against the font distinguisher block by a small coil spring. The lift should set so the back of the shoulder aligns with the vertical face of the rails. If by any accident it is forced out of alignment to the left, the lift can not engage the bottom of the matrices and lift them over the vertical face of the rails.

The shoulder and seat of the lift should be kept free from gum or dirt so the matrices will not slip off while being raised. When the shoulder and seat of the lift wear so that it will lift two thin matrices or lift them crooked, the lift must be replaced by a new one.

The cam lever and lift lever are connected by a cushion spring (*l* figure 40) which absorbs the movement of the cam lever, if the lever hangs up. There is an adjusting screw (*n* figure 40) in the matrix lift lever which permits the lift lever to be raised or lowered.

The matrix lift must raise the lugs of the matrices clear of the vertical face of the box rails. If it does not do this, thin matrices, when being moved by the distributor screws, would be forced against the vertical face of the rails by the screws and would become damaged. To adjust the lift, turn the distributor screws by hand until the cam roller is at the low part of the cam, place a thin matrix in the distributor box against the vertical face of the rails, then adjust screw until the shoulder of the lift is not more than $\frac{1}{64}$ of an inch under the bottom of the matrix. The lift then should raise the matrix $\frac{1}{32}$ of an inch above the top rails in the distributor box when the cam roller is at the highest part of the cam. After adjusting the lift, be sure that the adjusting screw locknut is tight.

The buffer (*c* figure 39) of the distributor shifter (*d* figure 39) should come in the box almost to the distributor

lift, but should never come in far enough to engage the lift. The distance the shifter can travel into the box is regulated by a stop screw which sets in the shifter slideway. However, this screw sometimes gets broken off, comes out, or is worn off. This would allow the shifter buffer to engage the lift and cause undue wear. The shifter slideway should be kept lubricated with dry graphite.

The font distinguisher (*a* figure 41) is placed in the

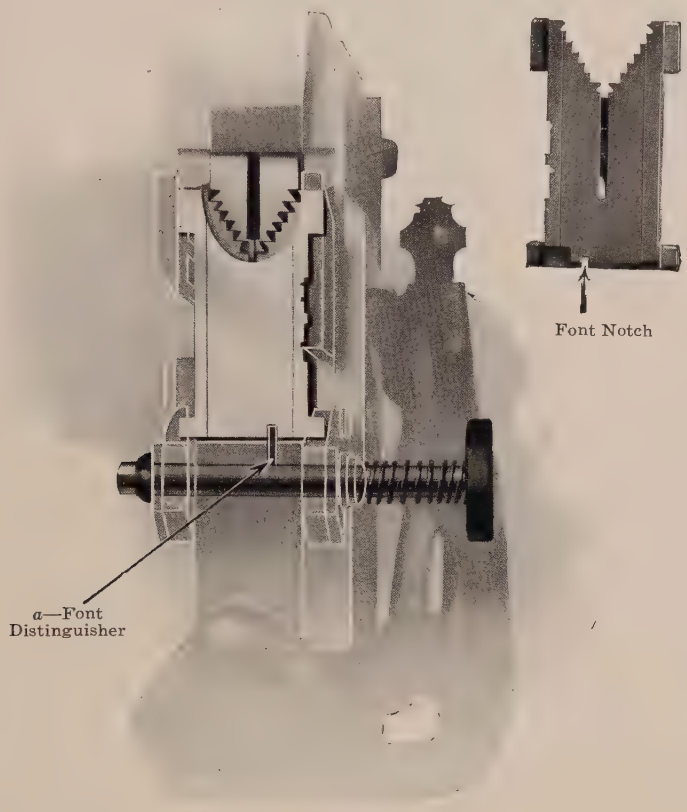


FIGURE 41

In the bottom of the distributor box there is a short knife-like vertical projection, which can be moved from front to back. Unless the notches in the bottom of the matrices meet the projection, the matrices can not pass through the distributor box, and the distribution of the matrices is stopped. This prevents 8-point matrices, for instance, from being distributed into a magazine of 6-point matrices.

lower right end of the box, between the two lower rails. All the matrices must pass this distinguisher. When properly adjusted, it will stop all matrices of a different font size to the one being used, or one of the same font turned backwards. The font distinguisher is automatically changed

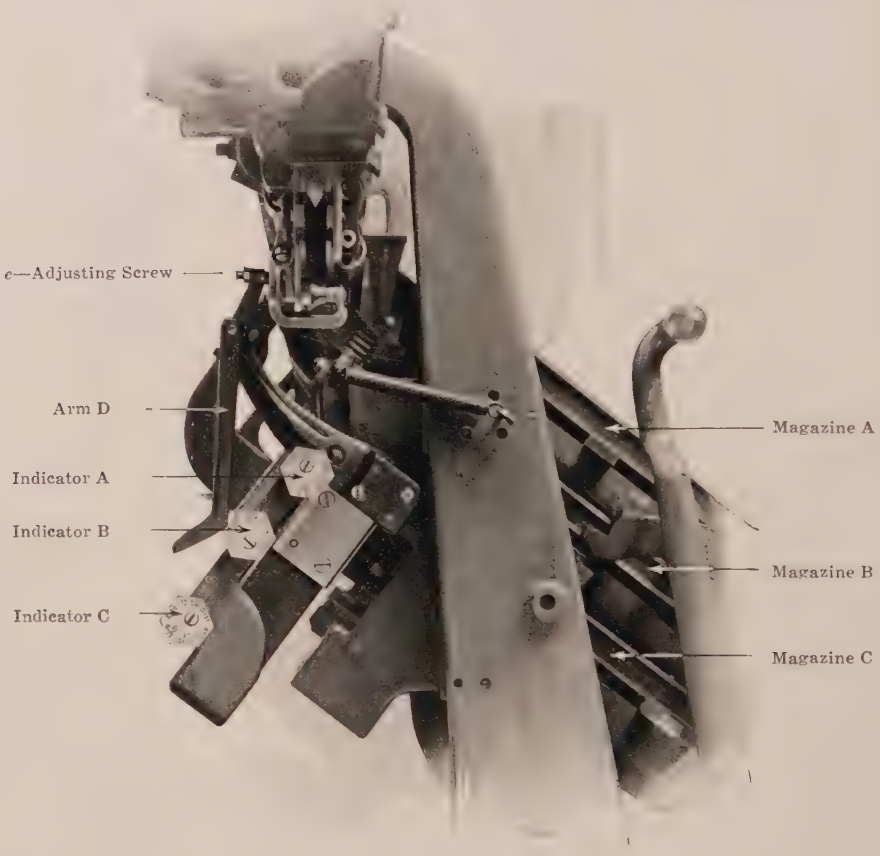


FIGURE 42

This illustration shows how the position of the arm *d* determines the position of the vertical knife-like font distinguisher.

when changing the position of the magazines (see figure 42). It is changed for the various font sizes by turning the hexagon indicators (A, B, and C figure 42).

Matrices must never be driven over the point of the distinguisher when they stop in the box, but should be pushed

to the second elevator bar and the wrong font or the turned matrix removed. Driving a matrix over the font distinguisher not only damages the matrix, but it also often breaks the font distinguisher and causes serious damage to the box by throwing the various parts out of their proper alignment.

The distributor box must be kept clean at all times. It should be washed with gasoline or denatured alcohol, using a small brush.

To Remove a Distributor Box. Back the machine until the second elevator descends from its seat. Pull down on the magazine channel entrance. Press in on the font distinguisher stud until the distinguisher is resting against the lower front rail of the box and turn the stud to right a quarter of a turn. Press downward on the handle of the screw which holds the box in position and unscrew until it stops. Pull downward on the box.

Care must be used in replacing the box to seat as high as it will go and have the washer on the screw so that it clamps the box bracket to the distributor beam. Turn upward on the handle of the screw.

The distributor box bracket is provided with pins (*r* figure 40) that fit in a groove in the distributor beam to prevent the box being placed in any other than the correct position.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figure 39.

2. Remove the distributor box from the machine.

3. Locate each of the parts shown in figure 40.

4. With some thin matrices, test the box rails and bar point to see if more than one matrix will pass at one time.

5. Examine the matrix lift, to see if the back of the shoulder aligns with the vertical face of the rails.

6. Locate the safety spring on the front box rail and note the position of the free end, as compared to the vertical face of the rail.

7. Clean the various parts of the distributor box.

8. Replace the distributor box. Note how the screw clamps the box to the frame.

9. Examine the distributor shifter buffer, and see how near it comes to the matrix lift when all the way to the right of the slideway.

10. Test the adjustment of the matrix lift.

11. Test the adjustment of the font distinguisher and see that the font distinguisher works freely.

QUESTIONS

1. What supports the matrices as they are being transferred onto the distributor box bar?

2. Why does the left end of the distributor box bar have up-and-down play?

3. What operates the distributor box lift?

4. How are the matrices raised from the distributor box and carried onto the distributor bar?

5. What will cause two matrices to lift at one time in the distributor box?

6. What will cause matrix lugs to bend in the distributor box?

7. How is the distributor box lift adjusted?

8. What will cause matrices to clog in the distributor box, and how are they removed?

9. Why should matrices never be forced past the font distinguisher?

10. How is a distributor box removed?

11. How is a distributor box cleaned?

12. What is the function of the safety spring on the front box rail?

13. How is the font distinguisher adjusted?

14. How is the font distinguisher changed for various fonts of matrices?

LESSON 15 — FIRST ELEVATOR JAWS AND SLIDE

The first elevator slide is held in place by four gibs (*a* figure 43) on the vise frame so that the jaws will stand parallel with the mold. The gibs are also used for adjusting the first elevator jaws so they will just clear the delivery and the intermediate channels. The slide is operated by cam No. 1, through the first elevator and the auxiliary levers and connecting link.

The first elevator jaws (*b* figure 43) are attached to the top of the first elevator slide. They carry the line of matrices to the casting position and then to the second elevator. When the matrices have entered the first elevator jaws they are in position with their face toward the mold. The elevator slide travels down to the vise, the mold advances and the lower lugs of the matrices enter the groove of the mold, the elevator raises for alignment and lifts the line against the aligning rib on mold keeper, ready for casting.

As the first elevator jaws descend to the vise cap, the center screw (*c* figure 43) in the top of the first elevator slide strikes on the vise cap and regulates the distance from the lugs of the matrices to the aligning rib on the mold keeper when the mold slide advances.

There should be $\frac{1}{64}$ of an inch space between the bottom of the center screw and vise cap when first elevator is lifted for alignment. If the center screw is not properly adjusted, the lower lug on the matrices would be sheared when the mold advances. An entire font of matrices might be ruined in a very short time in this manner.

To test this adjustment, place a good matrix in the first elevator jaws, turn the machine until the adjusting screw is resting on the vise cap, disconnect the mold slide and bring the mold disk forward so the lug of the matrix enters the groove in the mold. Raise the elevator slide with the left hand, which raises the lug of the matrix against the aligning rib on the mold keeper. At this point there should be $\frac{1}{64}$ of an inch between the end of the center screw and the

vise cap. If not, turn the screw (*c* figure 43) with the right hand until it is resting on the vise cap. Then turn the screw to the left until it is approximately $\frac{1}{64}$ of an inch from the vise cap.

The elevator jaws must be adjusted so as to clear the intermediate and delivery channels without binding. If they

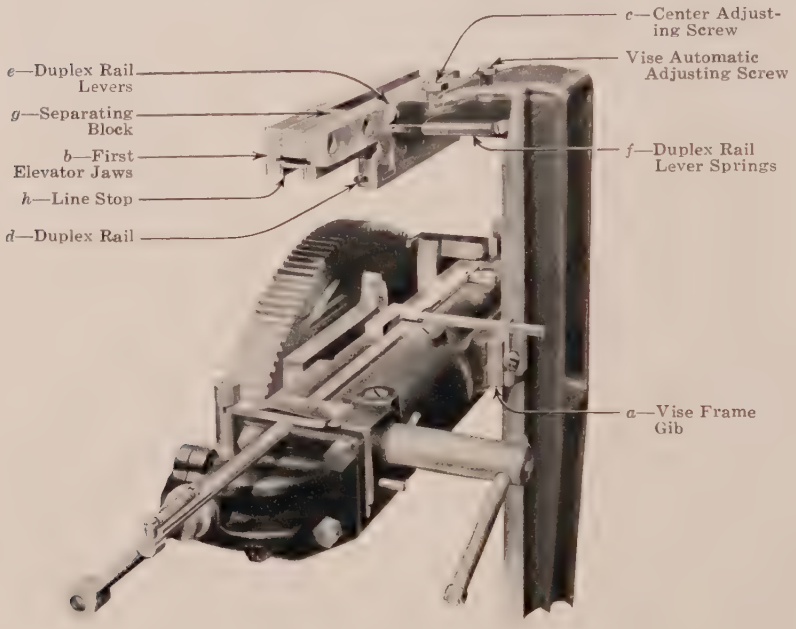


FIGURE 43

This shows the first elevator in normal position.

are too far away, move all four gibs exactly the same distance.

The first elevator jaws should align with the second elevator bar when the first elevator is at its full up-stroke, so that the matrices will pass freely from the first to the second elevator. When the first elevator goes to the slide guide, the square-head adjusting screw on the bottom of the slide comes in contact with the vise frame, regulates the height to which the elevator raises, the screw holding the slide, and the spring in the connecting link being compressed to take up the extra movement of the elevator lever.

Unless the matrices transfer freely from the first elevator jaws to the second elevator bar, the combinations would soon become damaged, causing poor distribution.

Test by transferring a line from the jaws to the bar by hand. If the line of matrices moves onto the bar without dragging, the adjustment need not be disturbed. If the matrices drag as they are moved from the jaws to the bar, adjust with the screw on the bottom of the first elevator slide, at the right side, so the combinations on the matrices align with grooves on the second elevator bar. The test for this adjustment, is to transfer the line as above stated. The line must transfer without dragging. Use the adjusting screw until this is accomplished.

Before making the adjustment be sure the first elevator jaws are not loose on the slide, that the left end of the second elevator bar is not battered, that the second elevator plate is not loose, or worn, that the second elevator is adjusted properly, that there is no dirt or gum holding the second elevator from seating, that there is no metal on top of the adjusting screw, that the screw which holds the first elevator slide stop is not loose. See that the transfer slide finger is not bent.

First Elevator Jaws. The first elevator jaws (*b* figure 43) consist of the front and back jaws, the jaw spring pawls, duplex rail (*d* figure 43), duplex rail levers (*e* figure 43), and springs (*f* figure 43), separating block (*g* figure 43), and line stop (*h* figure 43).

The two jaws are held together by two screws extending through the separating block. On the right-hand end of the jaws are the spring pawls. The pawl for the back jaw is held in a slot by two small screws and projects through to the front. The front jaw pawl is grooved and held in place by two screws and a plate, and projects through to the back. These two pawls retain the matrices after they have entered the jaws. Should they break or become inoperative, the matrices would have a tendency to jump out of the jaws just before entering the vise jaws or while going to transfer position in the top guide. A broken pawl sometimes will catch the line of matrices and prevent it from passing into

the jaws. To renew the front pawl, loosen the two small screws that hold the plate and slip the pawl toward the right. The back pawl can be changed by taking out the two small screws that hold it in position.

The first elevator front jaw is equipped with a duplex rail for the purpose of holding the matrices in a raised position to cast a line of matrices in auxiliary position. This rail is held in position by two springs which are fastened to the two duplex rail levers. The rail is automatically retracted when the elevator raises to the slide guide, by the upper ends of the rail levers being pressed back by two operating blocks which are assembled on the adjusting strip of the slide guide. This backward movement of the rail permits the matrices to drop to normal position for the transfer.

If a squirt occurs and the metal gets in around the duplex rails or on the first elevator jaws, it will prevent the rail from being retracted. This will prevent the elevator slide from going high enough for the matrices to be transferred. Never remove metal from the jaws with a screwdriver or a piece of steel. A piece of brass rule will answer the purpose and will not damage the jaws when driving out the metal.

The duplex rail sometimes becomes battered or bent through the carelessness of the operator in sending in tight lines. The rail can be taken out and smoothed up by taking the jaws off the slide and removing the plate at the bottom of the front jaw.

The back jaw should be examined frequently for burrs or a sprung jaw. If the jaw becomes sprung outward it will permit the end matrix to crawl up in the jaws and the lugs will be sheared or bent as the mold slide comes forward for the lockup. There should be just enough space between the jaws for a matrix to pass in without binding, but not enough to allow the matrix to be raised past the duplex rail, from lower to auxiliary position. If the jaw is bent inward, the spaceband can not operate freely. Keep the jaws clean at all times, so the matrices will not get dirt on them while in the jaws.

First Elevator Jaw Line Stop. The first elevator jaw line stop (*h* figure 43), which prevents the matrices from twisting or falling out while the line is being carried to the vise or the top guide, slides in between the front and back part of the first elevator jaw, and is held by a clamp, spring, and nut.

The outer end of the line stop is cut away so as to clear the vise jaw. Always have the cut on the under side; if reversed it would strike on the vise jaw and not allow the first elevator to descend the full distance.

The inner end of the line stop should set against the first matrix on the left end of the line after the line has been justified. Do not set the clamp locknut tight or it will not allow the line stop to move.

First Elevator Slide Connecting Link. The first elevator slide connecting link is the connection between the first elevator slide and the first elevator lever. It is fastened to the slide by a pin exending through an eyebolt, and to the first elevator lever by a wing pin extending through an eyebolt.

The first elevator jaws should not be more than $\frac{1}{64}$ of an inch lower than the grooves in the delivery channel. Make this adjustment by turning the connecting link casing.

The connecting link is constructed of a casing or tube, inside of which is a compression spring. This spring is held in place at the bottom by a movable nut inside of the lower end of the casing, and by a screw cap at the top of the casing. The movable nut has a slot on one side which fits over a pin in the casing. This prevents the nut from turning except when the casing is turned. The casing also has a screw cap on the lower end, through which an eyebolt passes. The lower eyebolt screws into the movable nut inside the casing, against which the spring rests. At the top of the casing is another eyebolt which screws into the top screw cap.

The upper eyebolt is $\frac{3}{4}$ of an inch from the inner edge of the hole to the shoulder of the upper cap, and the lower eyebolt $\frac{13}{16}$ of an inch from the inner edge of the hole to the shoulder of the bushing when applied to the machine, making $8\frac{1}{2}$ inches from center to center of the holes in the

eyebolts. The lower eyebolt is $\frac{1}{16}$ of an inch longer than the upper eyebolt. As the upper eyebolt has a left-hand thread and the lower eyebolt a right-hand thread, the lower eyebolt still remains $\frac{1}{16}$ of an inch longer than the upper eyebolt, and still retains the same compression on the spring when it becomes necessary to turn the connecting link a trifle to raise or lower the elevator.

The alignment of the matrices takes place as the elevator raises the lugs of the matrices up against the aligning rib on the mold keeper. By the lower eyebolt passing through the clearance hole in the screw cap when the alignment takes place, the lower nut is lifted against the spring inside the casing and the spring compresses just enough to align the lugs of the matrices in the groove of the mold. This holds the line against the mold by spring tension. If the connecting link was a solid piece, when the line was raised to the mold it would lock so tight that in a short time the lugs would be worn, causing a bad alignment of the matrices. The object of the spring inside the casing is to prevent this wear. Having the lower eyebolt $\frac{1}{16}$ of an inch longer than the upper, the correct compression of the spring is given. The elevator, when it raises from the vise for alignment with no matrices, is raised nearly $\frac{1}{3}$ of an inch. Notice the difference with a line of matrices in the elevator. It is held at the mold by the lugs of the matrices, the compression spring in the link taking up the extra motion of the first elevator lever.

Auxiliary Lever. The distance from center to center of the holes should measure $8\frac{1}{2}$ inches when the link has been properly adjusted. If the first elevator jaws do not come within $\frac{1}{64}$ of an inch of aligning with delivery slide channel after the connecting link has been adjusted and applied to the machine, adjust the slide with the auxiliary lever. This is necessary to compensate for wear on the face of cam No. 1 and the auxiliary lever roller. By loosening the connecting screw in the side of the auxiliary lever, make the adjustment by turning the adjusting screw in the front side of the auxiliary lever. Never try to make this adjustment with the connecting screw tight, as the lug of the auxiliary lever is liable to be broken.

SHOP PRACTICE

1. At the machine, locate all the parts shown in figure 43.

2. Test the adjustment for the downstroke of the first elevator slide.

3. Test the adjustment for the upstroke of the first elevator slide.

4. Test the adjustment to see that the slide comes close to, but not against, the delivery channels.

5. Examine the jaws, pawl springs, and duplex rails, to see that they are free from burrs, and that they work freely.

6. Examine the line stop, to see how it is held in place in the jaws.

7. With a line in the jaws, cause the casting mechanism to turn, and observe the action of the connecting link at the various points of movement.

8. Take the connecting link apart and note the various parts.

9. Replace the connecting link and test the adjustment which aligns the jaws with the delivery channel.

10. Examine the adjusting screws of the auxiliary lever, and note how the lever operates on the cam to give motion to the first elevator.

QUESTIONS

1. Describe the action of the first elevator slide and jaws, in carrying the matrices from the time they enter from the line delivery slide until they are transferred to the second elevator.

2. Name the adjustments for the first elevator slide, and tell how each adjustment is made.

3. Why is extreme accuracy in the adjustments of the first elevator so vitally important?

4. What damage will be caused at casting point if the downstroke adjustment is improperly set?

5. What damage will be caused if the upstroke adjustment is improperly set?

6. Explain the function of the first elevator duplex rail.

7. What prevents matrices from moving sidewise when being carried to casting and transfer position?

8. How should a squirt of metal be removed from the jaws?

9. What care should the duplex rail and jaws receive?

10. How should the line stop set in the jaws?

11. Describe the construction of the connecting link.

12. What is the purpose of the spring action of the connecting link?

13. What are the adjustments of the connecting link?

14. When should the adjustment in the auxiliary lever be changed?

LESSON 16—THE SECOND ELEVATOR

The Second Elevator. The second elevator consists of two levers, connected by a bolt and cushion spring. The short lever carries a roller which operates on cam No. 6. The short lever operates the long lever, to carry the matrices from the first elevator to the distributor box. On the

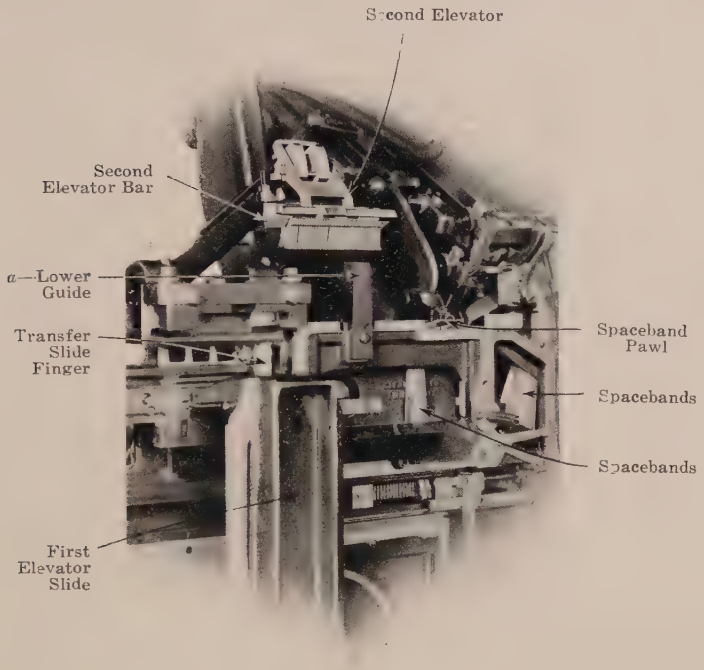


FIGURE 44
This shows the second elevator carrying a line to the distributor.

outer end of the second elevator lever is the bar link (*a* figure 45), the bar plate (*b* figure 45), and second elevator bar (*c* figure 45). The matrices are held on this bar by their combination teeth. On the right-hand end of the second elevator bar plate and elevator bar is a stop pawl, plunger, and spring (figure 45). The stop pawl prevents the

matrices from being pushed too far to the right during the transfer from the first elevator to the second elevator, and keeps the matrices from striking the distributor box bar when the second elevator is being raised to its upper position. When the elevator is seated in its upper position

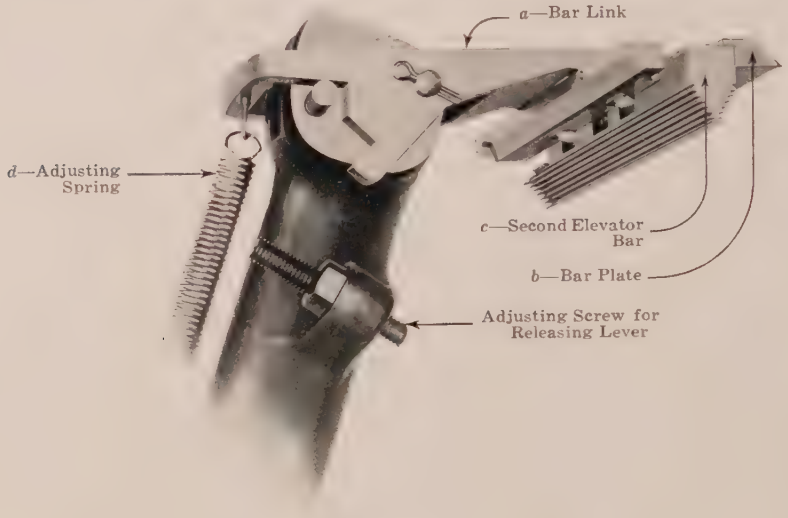


FIGURE 45

This is the "hand" on the end of the long arm of the second elevator. Its most important part is the toothed V-bar which engages the matrix teeth.

the stop pawl is raised by the plunger, so the matrices can pass onto the distributor bar.

An adjusting spring (*d* figure 45) hooks onto the bar link and the elevator lever. This spring allows the bar to seat properly at both the transfer channel and the distributor box. It holds the bar plate against the guide posts. There is a guide on the transfer channel (*a* figure 44) and one to seat the bar at the distributor box.

When the elevator is at transfer point, the roller should be free of the cam. Adjust by the nut on the connecting bolt which connects the two levers. This is to assure the elevator seating in its proper position on the transfer channel to receive the line of matrices from the first elevator. The machine should be in normal position, the automatic stop-

ping pawl resting on the upper stopping lever, when making this adjustment. With the machine in normal position, adjust so the connecting bolt is free to turn, with no end play between the head of the bolt and the adjusting nut. When this adjustment is properly made, and the machine is turned to transfer position, the roller will be free of the cam. When in normal position the second elevator bar will align with the bar of the distributor box. Unless the connecting bolt is free to turn when the machine is in normal position, the second elevator will not be properly seated in the distributor shifter guide, and the second elevator and distributor box bars will not align.

Should the bar plate become worn on the front side, it will allow the bar to seat out of alignment with the first elevator. The only remedy is a new bar plate. Keep the parts well graphited and wear on the points of friction will be reduced to a minimum. The bar sometimes becomes damaged by striking spacebands which have failed to transfer and are left in the transfer channel. Keep the bar free from burrs or nicks or the matrix combinations will be ruined in a very short time.

Second Elevator Starting Spring. Located just inside the machine frame, near cam No. 2, and connected to the short lever of the second elevator, is the second elevator starting spring and rod. When the second elevator is at transfer point, the second elevator starting spring bolt cap should touch the spring. The spring is to start the elevator down and prevent sticking at the distributor.

The most tension is on the spring when the machine is at normal position and as the cam revolves, the second elevator cam lever will get its proper movement when going to transfer position. The spring also causes a steady movement of the second elevator lever when going from transfer to normal position.

Second Elevator Safety Catch. On the end of the second elevator lever, near cam No. 10, at the front side of the lever, is a projection for the purpose of preventing the elevator from falling and being damaged should anything catch or hold the lever momentarily from following the cam.

This projection engages with a safety pawl on the machine frame. This pawl must be released before the lever roller can rest on the cam. When the elevator descends at its regular time, the safety catch is held open by a raised piece on the surface of cam No. 10.

To Remove the Second Elevator Bar. Turn the machine until the second elevator is almost to the transfer channel. Remove the second elevator, assembled, by removing the cotter pin from the second elevator bar link hinge pin, pulling the pin out and placing the second elevator on the work bench or table, remove the two screws which hold the bar to the bar plate. Push the bar plate back over the bar link as far as it will go. Push the fulcrum pin to the right to release the bar.

When replacing the bar, be sure to tighten the screws tight. If they work loose they will allow the bar to get out of alignment and damage the matrix combinations. The fulcrum pin must also be straight to allow the proper alignment of the bar.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figures 44 and 45.

2. Examine the combination bar, to see that it is free from burrs.

3. Examine the stop pawl, plunger, and spring, to see how they operate.

4. Test the adjustment for the second elevator.

5. Locate the second elevator starting spring, and observe how it operates when the machine is in action.

6. Locate the second elevator safety catch, and observe how it operates when the machine is in action.

QUESTIONS

1. How is the second elevator adjusted?

2. What happens if the second elevator is not properly adjusted?

3. What is the purpose of the stop pawl?

4. How is the stop pawl operated to allow matrices to be transferred to the distributor box?

5. What causes the second elevator bar to align with the first elevator jaws and the distributor box bar?

6. When does the safety catch operate?

7. What is the purpose of the second elevator starting spring?

8. What is the purpose of the adjusting spring?

9. What care does the second elevator require?

10. How is the second elevator bar removed?

LESSON 17 — MAIN CAMS

Main Cams. The main cams control the movements of the various levers of the machine and their operations are dependent on these cams.

The assembling and distributing mechanisms alone are independent of the main cams.

Standing at the rear of the machine and counting from the right, the cams have the following action:

Cam No. 1 (*a* figure 46) is the first elevator cam. This cam operates the first elevator slide, through the auxiliary and first elevator levers, by means of a connection made by a connecting link. This cam lowers the first elevator slide and jaws with the matrix line to the mold and then lifts it to the intermediate channel for the transfer to the second elevator bar. The elevator has five changes of position in its cycle of operation.

The second (*b* figure 46) is the distributor shifter cam. This cam is inside the frame of the machine, under cam No. 3, and to which it is fastened with two dowel pins and a screw. This cam operates the distributor shifter for transferring the matrices from the second elevator bar to the distributor box. This action is produced by a rider assembled in the distributor shifter hub which is fastened by a shaft to the mold gear arm. The rider is brought up against the face of this cam by a coil spring which is fastened to the lower end of the hub and to the frame of the machine. Assembled with the rider in the hub is a cushion spring that takes care of any undue strain that might occur in the action of the cams.

The third (*c* figure 46) is the mold turning cam. The two gear segments (*x* and *x* figure 46) attached to this cam impart rotation to the mold turning pinion which in turn revolves the mold disk. The short segment engages the pinion and turns the disk one-quarter revolution, bringing the mold in position to receive the line of matrices. The long segment in turn brings the disk and mold to ejecting position, completing the revolution of the cams.

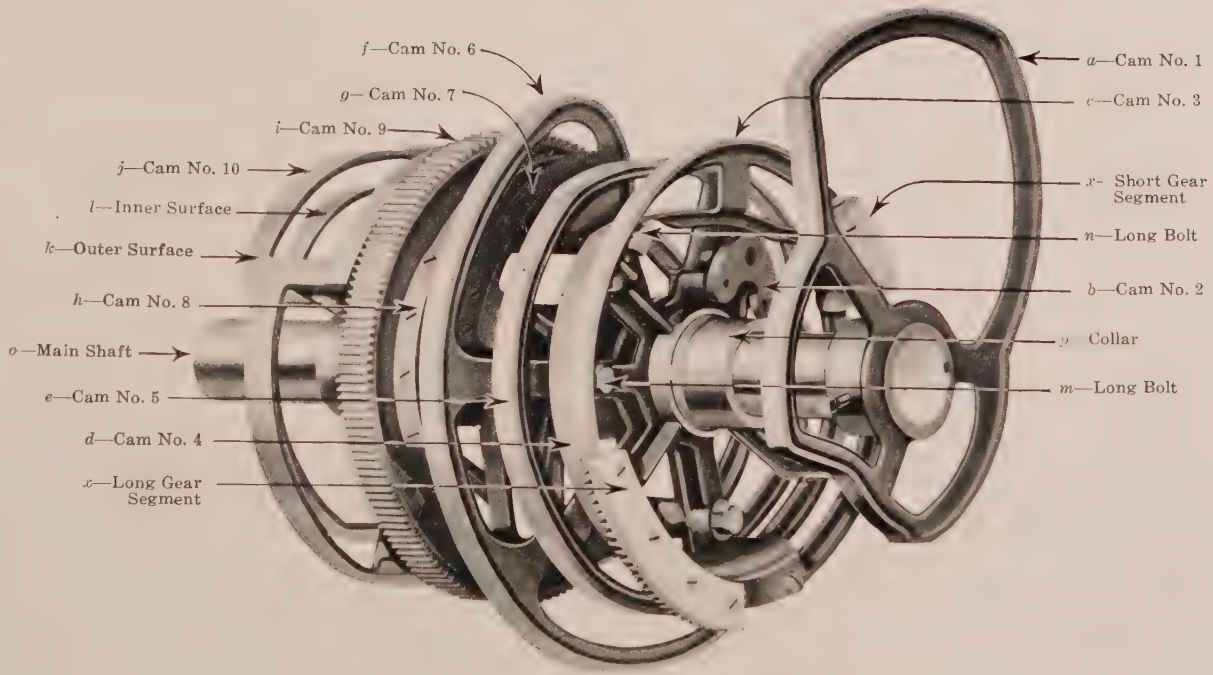


FIGURE 46

This illustration shows the ten cams and the main cam shaft which automatically control and accurately time all the major lever actions of the Linotype.

The fourth (*d* figure 46) (a part of cam No. 3) is the vise closing and second justification cam. The lever, directly under this cam, has a roller that follows the contour of the cam. A heavy coil spring beneath the lever presses the roller against the cam. The lever is forked at the front end and actuates the vise closing mechanism, and also acts with the justification lever in making second justification.

The fifth (*e* figure 46) is the justification lever cam. The lever directly under this cam has a roller that follows the contour of the cam. The heavy coil spring beneath the lever presses the roller against the contour of this cam, justifying the line of matrices by forcing the spacing mechanism against the spacebands. This lever in its downward motion operates the slug lever.

The sixth (*f* figure 46) (a part of cam No. 5) is the second elevator cam, which operates the second elevator arm by means of a roller following the contour of this cam. This arm, to which the lever is fastened, lowers the second elevator to receive the line of matrices at the transfer position and then raises them to the distributor box.

The seventh (*g* figure 46) is the pot pump cam and operates the pump lever. There is a roller on this lever resting against the face of the cam. This lever forces the metal into the mold cell as the cam revolves to the low portion. The pot pump lever is connected to its shaft and has a lever extending into the column. It is pulled downward by a stiff coil spring.

The eighth (*h* figure 46) is the pot cam, which acts on the pot lever, forcing the mouth of the pot forward against the mold. There are two shoes on this cam. The first or short shoe is to cause the face alignment; the second or long shoe is to lock the pot firmly against the mold before the slug is cast. A roller is carried in the pot lever and follows the contour of this cam and is the medium through which the above lockup is accomplished.

The ninth (*i* figure 46) is the mold slide cam and driving gear. The right side of this gear is channeled out, and carries the mold slide lever which operates the mold slide to advance the mold disk to a position in which the lugs of

the matrices are held in the groove of the mold for alignment. It also returns the mold disk after the line has been cast, advances it again to ejecting position, and returns it after the slug is ejected. This gear also carries the pot return cam, which withdraws the pot from the mold after the cast. It also carries the ejector cam which engages the pawl on the ejector lever and moves it forward, ejecting the slug from the mold.

The tenth (*j* figure 46) cam operates the delivery slide and transfer cam roller arms and causes these two parts to return to normal position after their respective movements. The delivery slide cam roller rotates on the outer surface (*k* figure 46) while the transfer slide cam roller acts on the inner surface (*l* figure 46). This cam also retracts the ejector lever after the slug has been ejected. The automatic safety and stopping pawls are attached to this cam. They are operated by the transfer slide and the delivery slide rollers. This cam really consists of two parts in one, the outer cam controlling the return of the delivery slide and the inner one controlling the return of the transfer slide lever.

The cams are all fastened together by four long bolts (*m* and *n* figure 46) extending from cam No. 2 and ending at cam No. 9. They are all keyed to the main shaft (*o* figure 46) and held in place by a set screw under cam No. 7. The cams can be shifted a little sidewise, but should set against a collar (*p* figure 46) on the left side of the main shaft under cam No. 2. Cam No. 10 is held in place by a key on the shaft and a set nut and is kept from working toward the left by a locating piece fastened to the main shaft.

The cams should be kept clean to prevent undue wear. Under ordinary conditions, the cams should be cleaned once each week. This may be accomplished by locking the controlling lever out so the cams will continue to rotate. Then hold a rag against the surface of the cam. A small amount of a mixture of gasoline and kerosene on the rag will help to cut all dirt and grit loose from the cams, and leave the surface in good condition and reduce the wear. Cams allowed to run without being cleaned will wear very rapidly and soon cause much trouble and expense.

SHOP PRACTICE

1. At the machine, trace out the mechanical actions caused by cam No. 1.
2. Trace out the mechanical actions caused by cam No. 2.
3. Trace out the mechanical actions caused by cam No. 3.
4. Trace out the mechanical actions caused by cam No. 4.
5. Trace out the mechanical actions caused by cam No. 5.
6. Trace out the mechanical actions caused by cam No. 6.
7. Trace out the mechanical actions caused by cam No. 7.
8. Trace out the mechanical actions caused by cam No. 8.
9. Trace out the mechanical actions caused by cam No. 9.
10. Trace out the mechanical actions caused by cam No. 10.
11. Clean the cams.

QUESTIONS

1. How are the main cams fastened to the shaft?
2. How are the main cams fastened together?
3. How should the main cams be cared for?
4. What mechanical actions are caused by cam No. 1?
5. What mechanical actions are caused by cam No. 2?
6. What mechanical actions are caused by cam No. 3?
7. What mechanical actions are caused by cam No. 4?
8. What mechanical actions are caused by cam No. 5?
9. What mechanical actions are caused by cam No. 6?
10. What mechanical actions are caused by cam No. 7?
11. What mechanical actions are caused by cam No. 8?
12. What mechanical actions are caused by cam No. 9?
13. What mechanical actions are caused by cam No. 10?

LESSON 18 — FIRST ELEVATOR SLIDE GUIDE, TRANSFER SLIDE, AND SPACEBAND LEVERS

First Elevator Slide Guide. The first elevator slide guide (*a* figure 47) contains the intermediate bar and pawl (assembled) (*b* figure 47), adjusting screws for the same, first elevator jaw duplex rail operating blocks (*c* and *d* figure 47), and the elevator transfer slide releasing lever.

The height of the intermediate bar and pawl is adjusted by two small screws (*e* figure 47) that pass through the top and touch the bar. The purpose of the bar and pawl is to push down any spacebands that may not have dropped to normal position as the line is carried from casting position to the transfer. If the pawl was set too high, the spacebands would strike the second elevator bar, and wear the lower rail.

The bar should be set so that when the second elevator is seated at transfer position, the pawl, when raised to its highest point, will be in line with the bottom of the second elevator bar. This adjustment is made with the two screws that pass through the slide guide and touch the intermediate bar. It is also necessary for both ends of the intermediate bar to be the same height. After adjusting the pawl, turn the machine until the transfer slide finger has entered the channel; lay a six-inch scale flat on the first elevator jaws in line with the bar, but clearing the pawl. Raise the first elevator slide by hand until the scale touches the bar. Adjust the bar horizontal with the scale by the same two screws that pass through the top of the slide guide.

Duplex Rail Operating Blocks. The first elevator jaw duplex rail operating blocks are fastened to the slide guide adjusting strip and have a limited adjustment, but when they are worn so they will not operate the rail properly, they should be renewed.

Releasing Lever. The releasing lever is for the purpose of preventing the transfer of a line in case the second elevator does not descend or seat properly. The adjusting

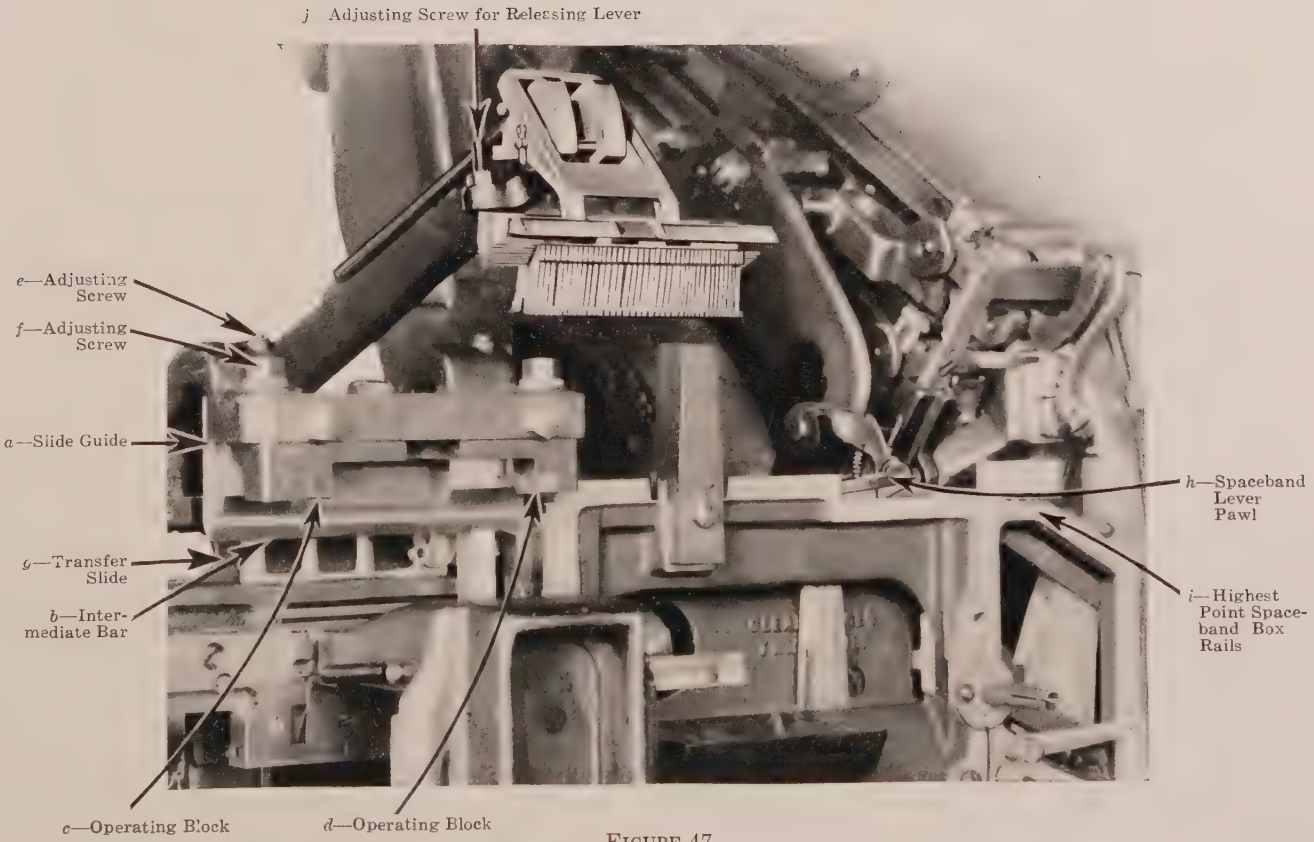


FIGURE 47

This illustration shows the matrices being lifted by the second elevator to the distributor.

screw in the side of the second elevator lever (*j* figure 47) should raise the left end of the releasing lever $\frac{1}{32}$ of an inch above the block on the transfer slide when the second elevator is seated in transfer position.

Transfer Slide. The transfer slide (*g* figure 47) gets its motion from the transfer lever to which it is connected by means of a link.

The transfer lever gets its action from the split transfer cam lever and roller, which are held against cam No. 10 by a coil spring in the column.

The slide should be adjusted to allow $5\frac{9}{16}$ inches from the intermediate channel to the slide finger. This adjustment should be made with the machine in normal position. Loosen the two screws on the split lever, move the slide finger $5\frac{9}{16}$ inches from the channel, and hold; then move the roller against the cam and tighten the screws. This adjustment is necessary so that a 30-em line, which measures 5 inches, will clear the transfer slide finger $\frac{5}{32}$ of an inch. The last matrix is carried $\frac{13}{32}$ of an inch inside the first elevator jaws. There will be a clearance of $\frac{5}{32}$ of an inch from the first matrix and the slide finger when the machine is in transfer position. Be sure the transfer finger is not bent when measuring this distance.

The cut in the slide finger should be flush with the left end of the second elevator bar plate, when it has transferred the line to the second elevator. This adjustment is made by the screw in the automatic safety pawl, which comes in contact with the buffer on cam No. 10.

With the machine in transfer position, the cam lever roller is against the buffer in cam No. 10. The adjusting screw in the automatic safety pawl, being against the inner end of buffer, regulates the distance between the cut in the finger and second elevator bar plate. This adjustment, when properly made, insures the line being moved from the first to the second elevator. Turning the adjusting screw to the right increases the distance between the slide finger and the bar plate. Turning to the left decreases it.

The horizontal screw in the tranfer slide should bank against the buffer in the spaceband lever to allow $\frac{1}{8}$ of an inch between the cut in the slide finger and the spaceband

lever pawl when the slide finger and the spaceband lever pawl are at their closest point during transfer.

After the line has been transferred to the second elevator, the spacebands, not having combination, remain in the transfer channel and must be moved under the spaceband lever pawl so they can be returned to the spaceband box. When the transfer cam lever roller is at the lowest part of cam No. 10, the adjusting screw in transfer slide, coming in contact with the buffer in the spaceband lever, regulates the distance between the cut in the slide finger and the bottom of the slot in the spaceband lever pawl. The slideway of the transfer slide should be lubricated with dry graphite.

Spaceband Lever. The spaceband lever gets its motion from the transfer lever, through a turnbuckle which connects the transfer lever and the spaceband lever. The purpose of this form of coupling, so threaded that when connecting the two levers, it may be turned to regulate the length of the connected parts, is to adjust the spaceband lever so the spaceband lever pawl (*h* figure 47) will pass the highest point of the spaceband box rails (*i* figure 47), properly bringing the spacebands into the box.

Before making the spaceband lever adjustment, make sure that the transfer slide finger is properly adjusted. Then place the machine in normal position. Adjust the turnbuckle so the hook of the pawl passes to the right of the highest point of the spaceband box rails not more than $\frac{1}{16}$ of an inch. If there is too much space between the end of the pawl and latch on the spaceband box, which is used as a lock, when recasting 30 picas the slide finger would move to the right against the line and force the matrix from the inner end of the first elevator before the pawl would come in contact with the latch. If the slide adjustments are properly made, the turning of the turnbuckle will have no effect in the adjustment of the slide finger.

Spaceband Lever Pawl. The spaceband pawl is fastened to the spaceband lever by a pivot pin and held in place by a bushing which fits over the pin. The screw which clamps the bushing to the pin extends downward through the top

of the lever. The pawl pulls the spacebands back into the box after the transfer. The pawl should ride freely in the transfer channel, its bearing being a pin screwed into the back side of the pawl. This pin rides on the top of the transfer channel. The sidewise adjustment of the pawl is made by loosening the screw in the top of the transfer lever and allowing the machine to turn over for a few lines, the pawl thus seating itself. The spaceband pawl is held down on the transfer channel by a small spring. The tension of this spring should be just strong enough to hold the spacebands from slipping from under the pawl.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figure 47.

2. Test the adjustments of the intermediate bar.

3. Turn the machine to transfer point and note the action of the operating blocks on the duplex rails of the first elevator jaws.

4. Test the adjustment of the releasing lever.

5. With the machine running, note the action of the transfer slide and spaceband lever.

6. Test all three adjustments of the transfer slide.

7. At the machine, locate the turnbuckle which connects the spaceband lever with the transfer lever, and note how the spaceband lever gets its motion.

8. With the machine running, note the action of the spaceband lever pawl, when transferring spacebands.

9. Test the adjustment of the spaceband lever.

QUESTIONS

1. What is the purpose of the intermediate bar and pawl?

2. How should the intermediate bar and pawl be adjusted?

3. Why is it necessary for the duplex rail to be pulled forward at the transfer point?

4. What is the purpose of the releasing lever?

5. What adjustments are there for the transfer slide, and how should they be made?

6. Explain how the spaceband lever gets its motion.

7. How should the spaceband lever be adjusted?

8. Why is it important that the spaceband lever be properly adjusted?

LESSON 19 — MOLD SLIDE

The mold slide (*a* figure 48), which carries the mold disk and molds, moves in a slideway at the right of the metal pot and gets its action from cam No. 9, and the mold cam lever on which are assembled two rollers. One roller is fastened to the lever by a screw and washer, and is seated in a depression (*b* figure 48) in the rear end of the mold slide, connecting the mold slide with cam No. 9. The other roller has as its bearing an adjustable eccentric pin fastened to the mold cam lever, and follows the contour of the cam in the right side of cam No. 9.

When a line of matrices is in position in front of the mold, the mold slide advances so that the lugs of the matrices will enter the aligning grooves of the mold. This position is held until the spacebands are driven up for justification and the line is raised for alignment. The slide then comes forward a second time for final lockup just as the metal pot locks against the back of the mold.

When the mold slide comes forward the first time there should be .010 of an inch space between the mold and the vise jaws or the line. This space between the mold and the jaws is regulated by the eccentric pin in the mold cam lever roller, and allows the proper justification and alignment of the matrices before the final lockup.

During the alignment and during the first justification, the matrices must be perfectly free, so that they may readjust themselves sidewise in the line. Hence the importance of preventing the mold from pressing forward against the matrices and spacebands at its first movement.

If the slide advances too far forward the aligning rail of the mold keeper would engage the lugs of the matrices before the first elevator jaws were seated properly on the vise cap, shearing the lugs of the matrices. Or if the mold was forced to lock up tight against the line, it would prevent justifying properly, causing hair lines to show between the matrices, or a squirt on the left-hand end. If there is too much space between the mold and the jaws, when the first

elevator raises for alignment, the lugs of the matrices not being in the aligning groove in the mold keeper, would permit the line of matrices to raise to the upper aligning groove of the mold, causing the line of matrices to be cast on the raised position; or if the aligning groove did not advance close to hold the lugs, there would be a small squirt.

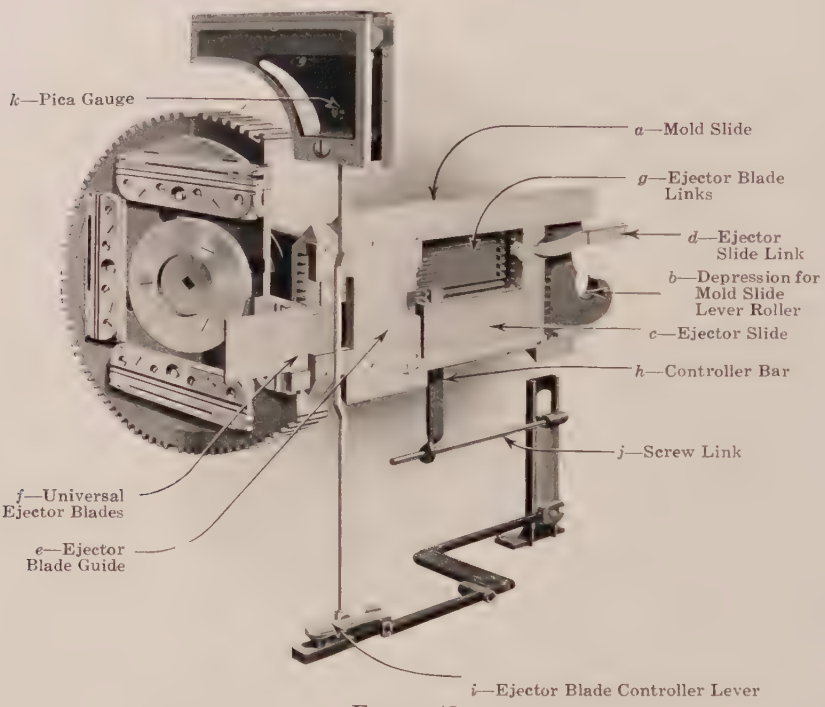


FIGURE 48

This illustration shows the mold slide and the ejecting mechanism.

The .010 of an inch adjustment also affects the lockup of the slide at ejecting position. If there is a trifle more space between the mold and the line than .010 of an inch, the mold will not seat against the banking block at ejecting point. This will sometimes allow the slug to twist slightly, causing it to be trimmed crooked.

To test this adjustment: Turn the casting mechanism until the first elevator jaws are resting on the vise cap; place a pig of metal under the head of the slide and on top

of the vise automatic stop rod; fold a piece of newspaper three thicknesses, or proof paper until it measures about .010 of an inch; close the vise jaws; place the paper between the mold and the vise jaws; turn the machine by hand until the metal pot is just ready to move forward; pull up on the paper, which should bind a trifle as it is being withdrawn.

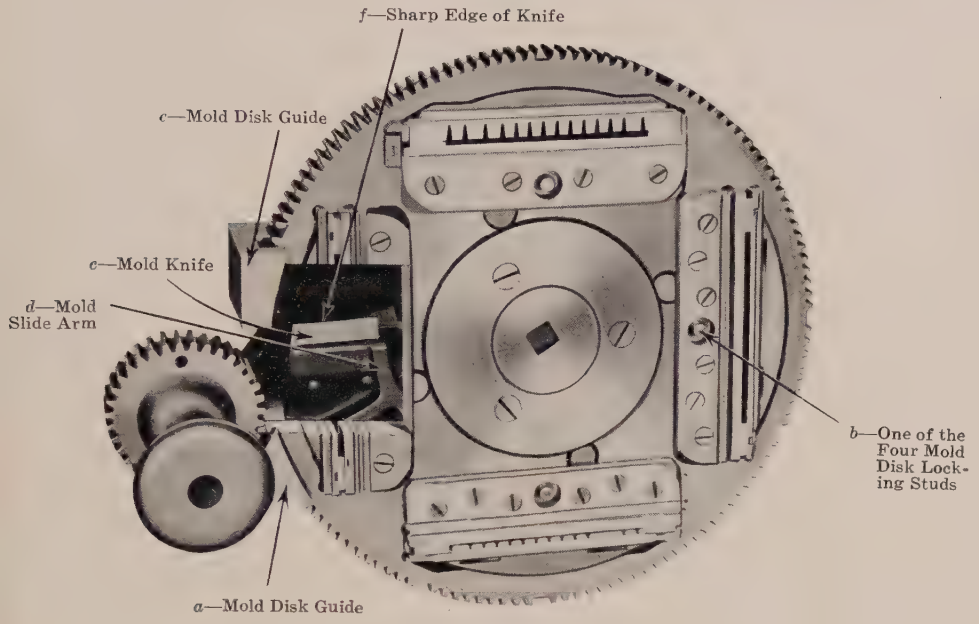


FIGURE 49

This shows the mold disk which revolves from its casting position for ejection. The mold containing the slug passes a knife which trims the bottom of the slug to make it type high.

If the paper does not bind or binds too tight it would show that the slide is out of adjustment.

To make the slide adjustment, place the paper between the jaws and the molds as in the test. Change the position of the mold slide by moving the eccentric pin in the mold cam lever roller so that the paper can be withdrawn, binding just a trifle. Moving the handle forces the mold slide either forward or backward, as desired.

The mold slide moves in a slideway. There should be about .007 of an inch play between the mold slide and the

slideway because the mold slide will expand from the heat of the metal pot, but by having the above mentioned play, it will not bind, and will slide in and out freely.

As the mold slide advances, it slides up on the locking stud block on the vise, raising the slide approximately .007 of an inch. The screw beneath the mold disk guide (*a* figure 49) on the mold gear arm should have a little clearance above it when the slide is forward on the locking stud blocks. There should be play enough to slip a sheet of paper between the screw and the guide when the mold disk is forward on the locking studs.

Mold Disk Locking Studs and Blocks. After the mold disk makes the one-quarter and three-quarter revolutions, the mold slide advances and the mold disk locking studs (*b* figure 49) enter the locking stud blocks which are on the vise. This keeps the disk in position until the slug has been cast or ejected, as the case may be.

The studs are in the disk and each bushing and block is made in one piece. The blocks are held to the vise by dowel pins and the screws that pass through the front of the vise and screw into the blocks. The left-hand stud block is loose sidewise, which permits the studs to enter the stud blocks with the minimum amount of wear to the parts.

The stud blocks can be renewed by taking the old ones off one at a time and using the remaining block as a guide.

The studs should be kept lubricated with a little graphite and grease. Too much will collect on the mold and get to the matrices.

Universal Ejector Slide. The universal ejector slide (*c* figure 48) is connected to the ejector lever by means of a link (*d* figure 48), and is located in the channel cut in the side of the mold slide. It is operated by the ejector cam, which comes in contact with the ejector lever pawl. The ejector cam is held tight to cam No. 9 by means of a screw and dowel pin. After the ejector lever is brought forward, it is pushed back into position by cam No. 10 coming in contact with a projection on the ejector lever. There is a buffer spring placed on the lower end of the ejector blade guide (*e* figure 48) which prevents the slide falling forward

with a sudden jerk after the ejector lever has passed its center of gravity and the slug has passed the resistance of the trimming knives. The spring works on a rod which banks against the ejector slide. If this spring is not functioning, the slug is liable to be thrown out on the floor.

The Universal Ejector Blades. The universal ejector consists of a series of blades (*f* figure 48) 5 points in thickness, in 2-em units; as a rule the first, or lower blade is a 4-em and then in 2-em units up to 30-ems pica. These unit blades move between plates, which brace them firmly on both sides, making them rigid and preventing the blade from bending.

The back end of the unit blades are fastened to ejector blade links (*g* figure 48) that move in grooves cut lengthwise of the slide. There is a link for each unit blade and they terminate at the back end of the mold slide in front of a groove milled across the slide. A movable controller bar (*h* figure 48) works in a groove in the ejector slide, moving up or down in the groove, back of a lug on each of the blade links. When the ejector lever forces the ejector slide forward, the controller bar in the groove of the slide comes against the lugs of the ejector links forcing the blades forward through the mold.

The blades are withdrawn by a lug on the ejector slide coming in contact with the lugs on the links.

When desiring to change the length of the blade to be used, move the ejector blade controlling lever handle (*i* figure 48) up or down. This handle is located below the starting and stopping lever and is connected to the controller bar by a screw link (*j* figure 48). Also connected to this handle is a pica gauge (*k* figure 48) which operates in a groove in the delivery channel.

Moving the handle up or down engages less or more blades, the length being indicated on the pica gauge in the delivery channel.

To Remove a Mold Slide. To remove the mold slide on machines which have a universal ejector, lower the vise to second position, set the ejector to 10 or 12 picas, take out the ejector blade controller link which screws into the

controller link lift. This will permit the controller bar to drop out. Disconnect the mold slide and take out the ejector lever link. If the machine is connected up with the water for cooling the molds, it will be necessary to disconnect the hose before taking out the slide.

When replacing the ejector controller bar it is necessary to have the mold slide and ejector slide in their normal position. The controller bar can not be replaced if the blades and groove in the slide do not align.

SHOP PRACTICE

1. With the machine running, note the various movements of the mold slide.

2. At the machine, locate the adjusting handle and the rollers which connect the mold slide with cam No. 9.

3. Test the lockup adjustment of the mold slide.

4. Test the adjustment of the mold slide as it raises on the locking stud.

5. At the machine, locate the locking studs and blocks, and note how they are fastened.

6. Remove the mold slide and place it on a bench.

7. Remove the ejector blade guide and study the construction of the ejector.

8. Replace the ejector blade guide and replace the slide on the machine.

QUESTIONS

1. How does the mold slide get its action?

2. How many movements of the mold slide are there during a complete revolution of the casting mechanism?

3. How should the mold slide be adjusted?

4. Why is extreme accuracy necessary in the mold slide adjustments?

5. What troubles would occur if the mold slide locked too tightly?

6. What is the purpose of the mold disk locking studs and bushings?

7. What care should the locking studs and bushings receive?

8. Describe the construction of the universal ejector.

9. How is the ejector changed for the various measures?

10. How does the ejector get its action?

11. How is a mold slide removed?

LESSON 20 — MOLD KNIFE, MOLD BANKING STRIPS, KNIFE WIPER, MICROMETER CALIPER

Mold Knife. The mold or back knife (*c* figure 49) trims the base of the slug and is fastened to the mold slide arm (*d* figure 49), back of the mold disk. It is placed at an angle of about 45 degrees and is held by two washers and two round-head screws which pass through the slotted holes of the knife. It is also held by two adjusting screws that set against the base so that the knife will set squarely and press lightly against the mold as the disk is turned from casting to the ejecting position. As the mold passes in front of the knife, the slug should be trimmed type-high, which is .918 of an inch.

The front of the mold disk, when turning, must be bearing against the mold disk guide (*a* and *e* figure 49) so as to keep the mold against the knife while the slug is being trimmed. If the mold disk guide does not set snugly against the disk, the disk will spring away from the knife and the slug will be higher on one end than the other. The guides are adjusted by loosening the screws which hold them to the mold slide and moving them snugly against the mold disk. Do not set the guide tight enough to bind and prevent the free turning of the disk.

It sometimes happens that a disk will bind at one or more places as it is being turned. This is due to the disk becoming warped from heat or some other cause. If it is only a slight bind it will not interfere with the adjustment.

Whenever it is necessary to put on a new or resharpened mold knife, or to adjust it, be sure the mold disk guides are bearing against the rim of the mold disk. It is always better to remove the guides and clean them as they must be perfectly clean when they seat against the disk. Always have the knife away from the mold when seating the guides. Tighten the hexagon-head screw on each guide slightly and then tap the guide until a slight pressure against the disk

is secured. Turn the disk by hand until an even pressure has been secured and then tighten the hexagon-head nut tight.

Place the mold knife on the knife seat; be sure the seat is clean, for the least particle of dirt or metal will make it more difficult to make the adjustment. Also the bottom of the mold must be perfectly clean and free from all metal. Set the knife square with, but not quite touching, the mold. Tighten down on the two round-head screws, then adjust with the two screws under the bottom of knife so that mold will turn without binding. The left-hand end of the knife trims the ends of the slugs; the center of the knife trims the center of the slugs. Avoid excessive pressure on either side as the knife is so shaped that the sharp edge (*f* figure 49) should just touch the mold.

After making sure that the guides and the knife are properly set, cover the back of the mold with a thin coating of red lead or printers' ink; turn the disk and mold until the mold passes the knife. If the knife is adjusted properly, it should scrape the lead from the mold. It is not always an easy matter to set a mold knife, taking considerable patience and care because the knife must be set to thousandths of an inch. Cast a slug and measure with the micrometers to make sure the slug is trimmed to the proper height. When measuring the slug for height with micrometers, use a slug 15 picas in length, or one that fills half the capacity of the mold. Have the regular letter characters cast on the slug.

Metal will adhere to the bottom of the mold if the mold knife is not sharp or properly adjusted. To keep a perfect lockup the bottom of the mold must be kept clean. Mold knives can be resharpened, but as they are shaped to set just so the edge of the knife touches the mold and must not vary, for even .001 of an inch will spoil the adjustment, they should be shipped to the nearest Linotype agency to be resharpened.

Be sure the knife is at fault before starting to adjust it.

Mold Banking Strips. The mold banking pieces (*a* and *b* figure 53) are fastened to the vise, one above the parallel knives and the other one below the bottom end of the knives.

These pieces prevent the mold from coming in contact with the knives and hold the disk rigid when ejecting the slug, assisting the knives in trimming the slug parallel. The mold slide should advance the proper distance so the mold will just bank against the banking pieces when forward for ejecting the slug.

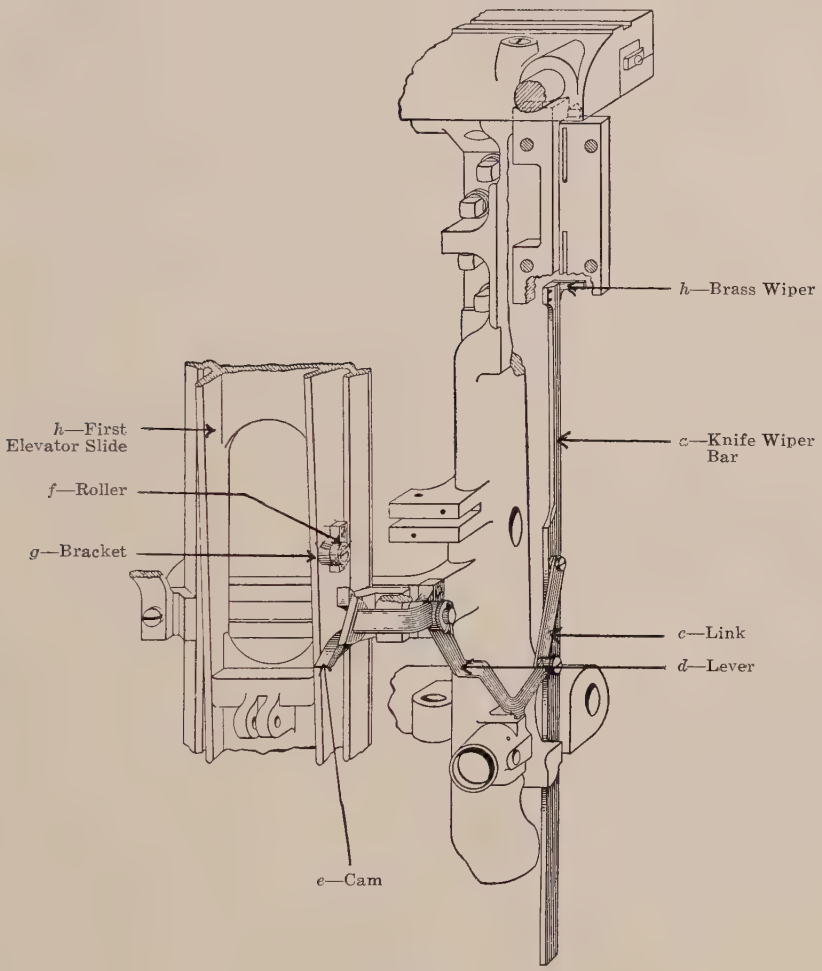


FIGURE 50

This is the knife wiper. Its function is to clean the burrs or slug trimmings from the face of the parallel knives after a slug is ejected.

Knife Wiper. The knife wiper (figure 50) is a very important part of the Linotype. Its function is to wipe the burrs or slug trimmings from the face of the parallel knives after a slug is ejected. If the knife wiper is not working, the face of the slug will have an accumulation of shavings from the previous slug on it.

The knife wiper is operated by a small roller (*f* figure 50), fastened to a bracket (*g* figure 50) on the first elevator slide, which comes in contact with a cam (*e* figure 50) and a lever (*d* figure 50) connected to the knife wiper bar (*a* figure 50). When the elevator goes from normal to the lower, or casting, position, the knife wiper bar is forced upward. On the upper end of the knife wiper bar is a small brass wiper (*b* figure 50) which is forced upward with the bar. This wiper rubs against the trimming knives, removing the metal shavings which may have lodged from the previous slug trimmed.

There are no adjustments on the wiper, except to have the brass lightly touching the knives.

The brass wiper is held to the bar with two flat-head screws, and the constant passing of the wiper over the face of the sharp knives soon wears the wiper so it will break off. A new wiper must be applied or the shavings will hang to the slugs.

Never have the wiper bearing too hard on the face of the knife as the constant rubbing up and down will dull the trimming edge of the knives and wear the wiper.

Do not forget that the knife wiper is operated by the first elevator slide. Therefore anything that prevents the free action of the wiper will interfere with the movement of the first elevator.

Micrometer Caliper. The chief mechanical principle embodied in the construction of a micrometer is that of a screw free to move in a fixed unit. The spindle (C figure 51) of the micrometer is attached to the thimble (E figure 51) at the top point, and extends downward through the inside of the sleeve (D figure 51) ; the thimble extending downward on the outside of the sleeve. The part of the spindle, which is concealed within the sleeve and thimble, is threaded to fit a nut in the frame of the micrometer. The pitch of the

screw threads on the concealed part of the spindle are 40 to the inch. Therefore one complete revolution of the spindle draws it back $\frac{1}{40}$, or .025, of an inch.

The sleeve is marked with 40 lines to the inch, corresponding to the number of threads on the spindle. When the spindle is down against the anvil, the beveled edge of the thimble coincides with the line 0 on the sleeve, and the 0 line

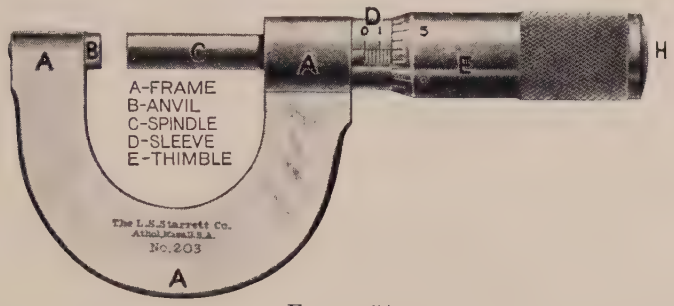


FIGURE 51

This is a micrometer caliper. The chief mechanical principle embodied in its construction is that of a screw free to move in a fixed unit.

on the thimble coincides with the horizontal line of the sleeve. By turning the knurled thimble with the thumb and finger until the 0 line on the thimble again agrees with the horizontal line on the sleeve, the distance between the anvil and the bottom point of the spindle will be $\frac{1}{40}$, or .025 of an inch, and the beveled edge of the thimble will coincide with the second vertical line on the sleeve. Each vertical line of the sleeve indicates a distance of $\frac{1}{40}$, or .025 of an inch. Every fourth line on the sleeve is made longer than the others, and is numbered 0, 1, 2, 3, 4, etc., up to 0 or the capacity of the micrometer. Each numbered line indicates a distance of four times $\frac{1}{40}$ of an inch, or $\frac{1}{10}$.

The beveled edge of the thimble is marked in twenty-five divisions, and every fifth line is numbered from 0 to 25. Turning the spindle from one of these marks to the next indicates that the spindle has been moved $\frac{1}{25}$ of .025, or one-thousandth of an inch.

Hold the frame (A figure 51) stationary and revolve the thimble with the thumb and finger. The spindle being attached to the thimble, revolves with it, and moves through

the nut in the frame, approaching or receding from the anvil (B figure 51). The measurement of the opening between the anvil and the spindle is shown by the lines and figures on the sleeve and the thimble.

To read the micrometer, place the piece to be measured on the anvil, turning the thimble up or down until it touches the piece lightly. Multiply the amount of vertical divisions visible on the sleeve by 25 and add the number of divisions on the bevel of the thimble from 0 to the line which coincides with the horizontal line on the sleeve.

For example if there are 5 divisions visible on the sleeve and 6 lines showing on the thimble, multiply 5 by .025, and add .006. Total .131 of an inch.

SHOP PRACTICE

1. At the machine, locate the mold or back knife, the adjusting screws, and the mold disk guides.
2. Cast a slug and measure for height.
3. Test the mold disk guides, to see that they set properly against the disk.
4. Make the mold knife adjustment.
5. At the machine, locate the mold banking strips.
6. With the machine running, study the action of the knife wiper.
7. Study the micrometer caliper, locating each of the parts shown in figure 51.

QUESTIONS

1. Why is it important that all Linotype slugs be of uniform height?
2. What is the purpose of the mold disk guide?
3. How is the mold knife adjusted?
4. Why should a slug 15 picas in length be used for adjusting the mold knife?
5. What is the purpose of the mold banking strips?
6. What is the purpose of the knife wiper?
7. What care should the knife wiper receive?
8. How can the knife wiper interfere with the movement of the first elevator?
9. Explain how a micrometer caliper is read.

LESSON 21—KNIFE BLOCK AND TRIMMING KNIVES

The Universal Knife Block. The knife block is held to the right side of the vise frame by two hexagon-head machine screws and is held rigid by four dowel pins. The trimming knives (*r* figure 53) are fastened to the knife block and the frame of the vise. When the slug is forced from the

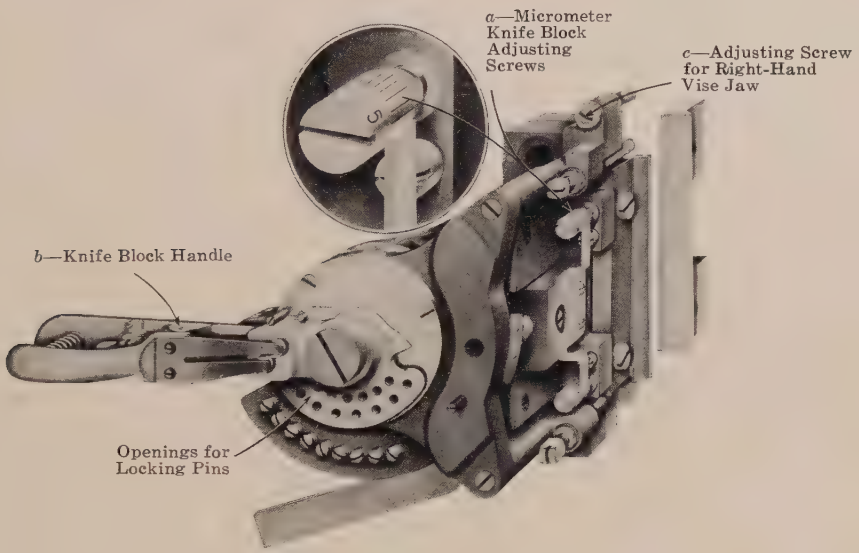

a—Micrometer Knife Block Adjusting Screws
c—Adjusting Screw for Right-Hand Vise Jaw
b—Knife Block Handle
Openings for Locking Pins

FIGURE 52

This shows a close-up view of the micrometer screw used on late model machines, by which the right-hand trimming knife is adjusted.

mold there are small rib projections and burrs that must be trimmed off. The slug passes through the two parallel trimming knives, held rigid by the knife block, which trims the slug parallel and clean. A slug may be trimmed to any size desired from 5 to 36 point by merely moving the handle (*b* figure 52) on the knife block. Whenever it is desired to remove the knife block, it is only necessary to take out the two machine screws and work the block out so the

dowel pins will come out of the holes. As the block is rather heavy, care must be used not to drop it or bend the pins.

Trimming Knives. The purpose of the trimming knives is to trim the slugs to the proper size and the sides parallel.

The measurement of a type-founders point is .0138$^{1}/_{3}$ of an inch. The measurement of a linotype point is .014 of an inch.

The point unit now used on the matrices is the one used by the type-founders. The linotype point is still being used when adjusting the trimming knives. A 10-point slug, when trimmed correctly, should measure .140 of an inch, or 10 times .014 of an inch.

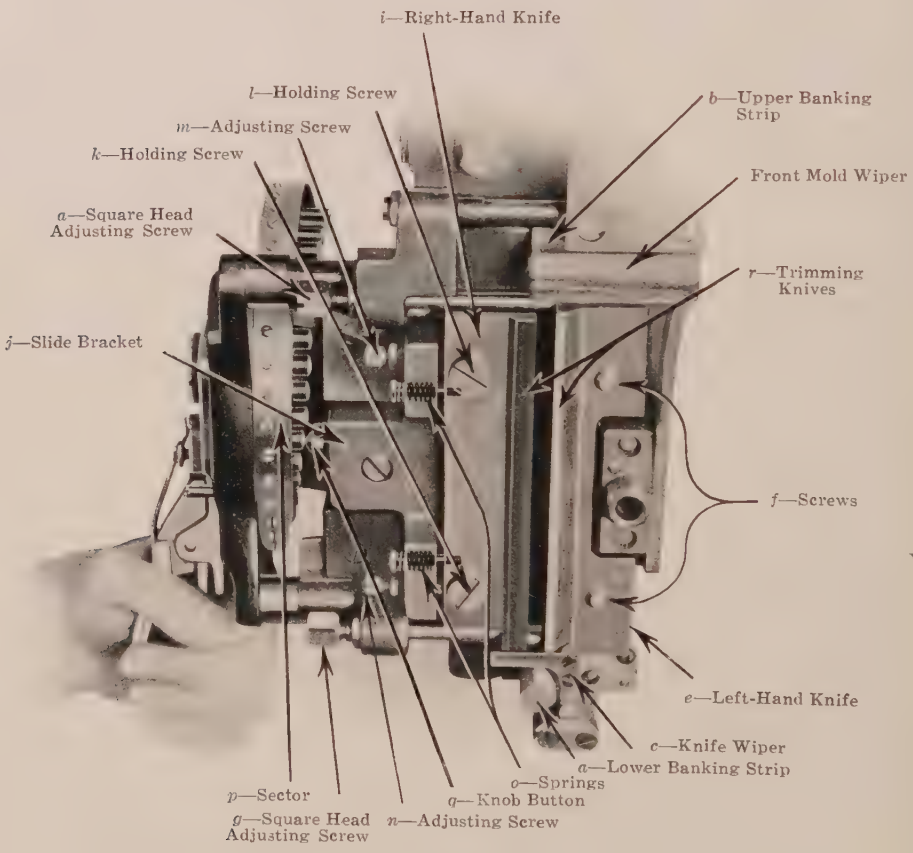


FIGURE 53

This is the Linotype universal knife block.

The left-hand knife (*e* figure 53) trims the overhang from the smooth side of the slug and is held to the vise by two square-head screws (*f* figure 53) that pass through to the front. It is adjusted by two screws (*g* and *h* figure 53), at the top and bottom of the knife block and bearing against the knife. This knife should be adjusted to be in line with the left side of the mold; it is only intended to remove the fins which form at the top of the slug. It is not intended to remove metal from the smooth side of the slug.

If the left-hand knife does not trim the overhang off the slug, it will cause the slugs to be thicker at the top than at the bottom and be off their feet. This will cause trouble in the lockup of the form, the columns having a tendency to raise up in the center.

Always loosen the two screws which hold the knife to the vise when making any adjustment of the left-hand knife. Turning in on the adjusting screws without loosening the two lock screws may cause the knife to spring and trim the slugs more in the center than on the ends.

The right-hand knife (*i* figure 53) trims the slug to thickness, and is held to the slide bracket (*j* figure 53) on the knife block, by two round-head screws (*k* and *l* figure 53). It is forced to the right against the adjusting screws (*m* and *n* figure 53) by two springs (*o* figure 53). The screws that hold the knife to the bracket should be loose when moving the adjusting screws outward, as the spring should force the knife against the adjusting screws in this movement. It is not necessary to release the screws that hold the knife to the bracket when turning the screws inward as the screws are forced against the knife in this adjustment.

The screws in the sector (*p* figure 53) are set to step from one point size to another and should not be changed except when necessary to trim any body size to a special thickness.

Beneath the bracket to which the knife is fastened are two spiral springs that force the bracket and knob button (*q* figure 53) against the sector screws. Moving the lever operates the sector, and the screw coming in contact with the button on the slide causes the knife to move in or out one point or as many as the lever is moved.

After having the knives adjusted to trim one size slug, the knife block is constructed so as to trim all others, by merely moving the handle on the knife block. When changing the universal knife block, be sure that one of the lever detent pins has entered the hole in the sector.

Whenever it is necessary to adjust the trimming knives, first set the right-hand knife by turning the two adjusting screws that are in the knife block slide bracket and touching the side of the knife, so it will trim the ribs of the slug; then adjust the knife that trims the overhang from the smooth side of the slug; then readjust the right-hand knife to thickness and parallel. Do not attempt to adjust the knife that trims the overhang from the smooth side of the slug unless the right-hand knife is trimming the ribs.

Knife, Right Hand, Spring Plate. There is a steel plate assembled in the right side of the knife block which keeps the slugs upright as they travel through the knife block into the stick. This plate is called the knife spring plate and is held in place by two lugs at the back of the plate extending into the base of the right-hand knife. It is forced toward the left by a flat bronze spring, called the spring plate spring. There should be just enough tension on this spring to force the plate up against the outgoing slug with an even pressure so the slug will be held upright as it is being pushed into the stick by the ejector blade. The flat spring is so shaped that the ends fit behind rivet heads, to hold the plate in place. If the spring becomes bent so it will not stay behind the rivets, the lugs will work out of their seat and the gate will obstruct the passageway of the slug. This will oftentimes smash the face of the slugs.

Facts and Suggestions About Trimming Knives. The right-hand knife must be adjusted so that its edge is exactly parallel with the left-hand knife in order to make the slug of equal thickness throughout its length. The faces of the two knives separate slightly toward the front of the machine, which allows the slug to pass freely forward from the cutting edges. Care should be used in assembling the knives that nothing is under the knives that would change the angle. By having this angle the "gouging" of the knife into

the slug is prevented, and slugs are trimmed to equal thickness at the top and bottom.

Always remember that the knives can be set to trim the slugs perfectly from one point size to another with accuracy, but it requires patience, as the knives must be adjusted to a thousandth part of an inch.

Keep the knife block and the knives clean. The seat of the knives should also be clean. It will be impossible to get an accurate adjustment if dirt or gum interferes with the movement of the knives.

The trimming knives should have exceedingly sharp or thin edges to work satisfactorily. If the knives become very dull or the cutting edge rounded or nicked, they should be taken off the machine and reground. Send them to the nearest agency as they are equipped with grinders and other fixtures to do this regrinding and maintain the correct angle and shape of the knives. Always send both the right-hand and the left-hand knives, as they should be reground in pairs, and the cutting edges should exactly match each other in order to obtain good results.

Use a full measure slug when adjusting the trimming knives. Cast a full line of capital letters on the slug and hold the matrices for recast. Measure the slug on the ribs at the top and near the bottom. The slug should measure the same at the top edge and near the bottom if the knife which trims the smooth side is correctly set. The slug should measure the same at the top edge of both ends if the knife which trims the rib side of the slug is correctly set.

Before setting the trimming knives, make sure that the mold is properly seated in the mold disk and that there is no metal between the liners and the mold.

When the trimming knives become dull it is practically impossible to set them to trim accurately. Even when they are set nearly accurate, they will hold the adjustment only a short time.

Dull knives also cause trouble by making it difficult to eject the slug. This often causes the clutch to slip.

When a long slug measures thicker or thinner at the ends than in the center, it is usually due to dull knives, but

may be caused by the knives being forced in a twist or strain by the adjusting screws or some foreign substance behind the knives.

SHOP PRACTICE

1. At the machine, study the action of the knife block when changing the point size, as illustrated in figure 53.
2. At the machine, locate each of the parts shown in figure 53.
3. Study the action of the various parts shown in figure 53, while changing the point size.
4. Test the adjustment of the knife which trims the smooth side of the slug.
5. Test the adjustment of the knife which trims the rib side of the slug.
6. Open the knives the full distance, and locate the knife spring plate.

QUESTIONS

1. What is the purpose of the trimming knives?
2. Why is it important that the trimming knives be accurately adjusted?
3. How is a knife block removed from the machine?
4. How are the knives changed for point thickness of slugs?
5. What is the purpose of the left-hand knife?
6. How is the left-hand knife fastened to the vise?
7. What trouble is caused when the left-hand knife does not trim properly?
8. What is the purpose of the right-hand knife?
9. How is the right-hand knife adjusted?
10. What is the purpose of the right-hand knife spring plate?
11. Explain how a slug should be measured when testing thickness.
12. What care do the trimming knives require?
13. When should the knives be sent to the factory for resharpening?
14. What troubles are caused by dull trimming knives?

LESSON 22 — MOLD TURNING CAM, SQUARE BLOCK, AND PINION

The mold turning cam, known as cam No. 3, has attached to its side the long (*b* figure 54) and the short (*c* figure 54) gear segments which impart rotation to the mold turning pinion (*d* and *g* figure 54) and square block (*e* figure 54) as the cam revolves. The square block and pinion are found on the inside of the mold gear arm. The gear segments on the mold turning cam turn the beveled pinion, the spur pinion turns the pinion (*j* figure 54), the pinion turns the mold turning shaft (*h* figure 54), and the mold turning shaft turns the mold disk (*n* figure 54). The shaft (*h* figure 54) is connected to the mold disk pinion (*n* figure 54) by a small pin (*l* figure 54) which extends from the shaft into a hole in the pinion. The pinion is held onto the pin by a coil spring in the hand wheel (*k* figure 54). The short segment turns the mold disk one-quarter of a revolution so as to bring the mold disk into casting position. The long segment turns the disk three-quarters of a revolution, bringing the mold and disk into ejecting position. The mold disk makes one complete revolution in one revolution of the cams.

When the disk makes one-quarter revolution, it is advanced so as to lock the stud block on the vise with the studs on the mold disk, and the slug is cast; the mold then is withdrawn and makes a three-quarter revolution, advancing again and locking to eject the slug. When the mold disk makes the quarter and three-quarter revolutions, all lost motion must be taken up by the square block on the pinion. If there is any lost motion, the studs on the mold disk would not be parallel with the stud blocks on the vise so that they could not enter them without coming in contact with the rim of the stud block.

Adjusting Shoes. On the mold turning cam are two adjustable steel shoes for the purpose of taking up the play between the shoes and the square block when in the casting and ejecting position. These shoes are adjusted by screwing

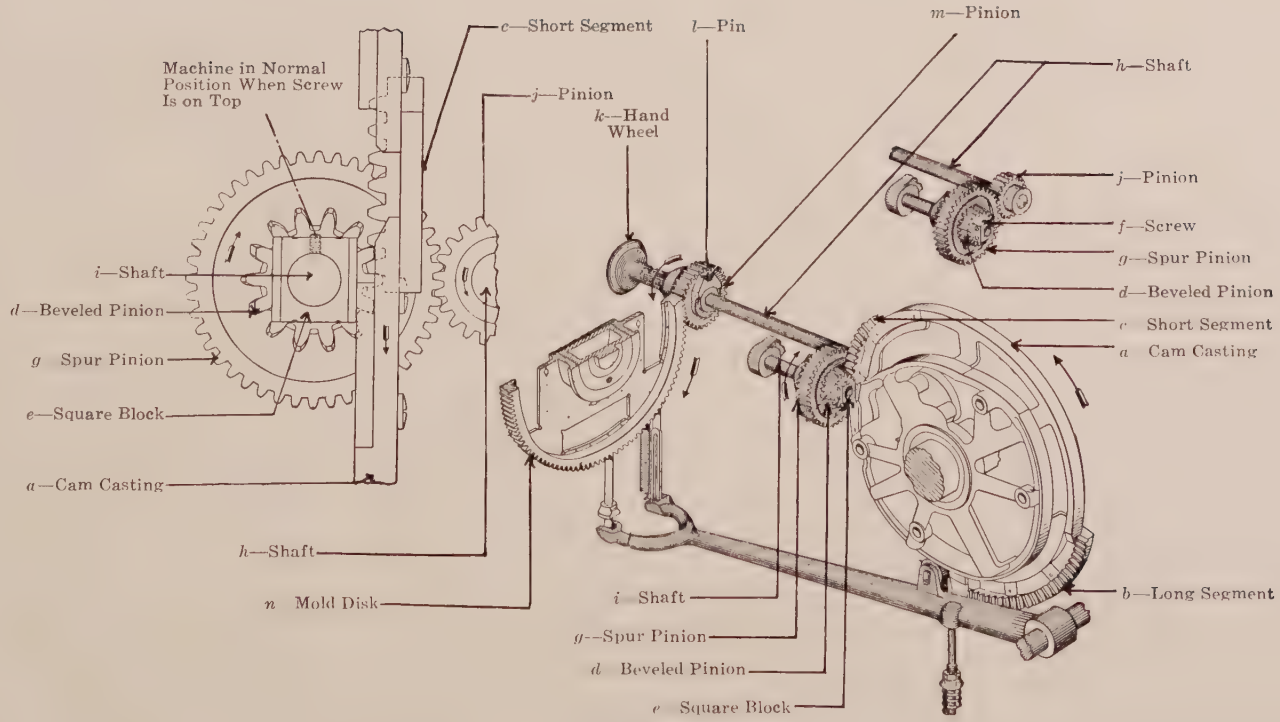

Machine in Normal Position When Screw Is on Top
c—Short Segment
l—Pin
m—Pinion
h—Shaft
j—Pinion
k—Hand Wheel
j—Pinion
f—Screw
g—Spur Pinion
d—Beveled Pinion
c Short Segment
a Cam Casting
i—Shaft
d—Beveled Pinion
g Spur Pinion
e—Square Block
a—Cam Casting
h—Shaft
n Mold Disk
i Shaft
g—Spur Pinion
d Beveled Pinion
e Square Block
b—Long Segment

FIGURE 54

in on the bushing screws that extend through the cam and bank against the shoes. Each shoe is held in place by two machine screws that extend through the bushing screw into the shoe. When adjusting the shoes care must be taken to make them parallel. The distance from the front end of each shoe to the outside of the cam must be the same as it is from the back end of the shoe to the outside of the cam. If these shoes are adjusted wider at the back than at the front they act as wedges as they go down by the square pinion, and may break the cam at the weakest point. If a shoe is set too tight against the square pinion it will break the cam. All that is necessary is to adjust them so as to take up the lost motion between the shoes and the square pinion. It is better to use a micrometer to measure the shoes to make sure they are parallel. Allow a trifle lost motion between the square block and the shoes, because it is better for them to have a little play than to be too tight and perhaps break the cam.

The square block and pinion are held in position on the shaft by a set screw, and there is no adjustment except to have this screw on the top when the machine is in normal position. The screw passes through the square block to the shaft and must enter the spot drilled on the shaft for the point of the screw so as to hold the pinion tight. On the two sides of the square block are two steel shoes, which are held to it by screws. These shoes can be nenewed when they become worn.

Mold Driving Shaft Friction Clamp. The object of the friction clamp is to prevent the mold disk from vibrating when advancing to the casting or ejecting position. It is attached to the mold driving shaft and is held by a pin in the mold gear arm. The lost motion in the several pinions from which the mold disk gets its action, will cause the disk to vibrate when stopping ready to advance on the vise stud blocks, unless it is held by the clamp which acts as a brake.

When the mold disk has made the one-quarter and three-quarter revolutions it must remain in that position, or the locking studs, coming in contact with the rims of the stud block, would wear.

The friction clamp which overcomes the vibration is made in two sections, with a leather lining, and connected

to the mold turning shaft. A spring, washer, and locknut add to its construction. The pin in the mold gear arm, to which it is also connected, prevents it from turning with the shaft. Do not have more friction than necessary, for if there is too much, the main clutch could not drive the machine, as the strong friction on the clamp would overcome the pull of the clutch spring.

Retiming Mold Gears. There are various methods of retiming the gears of the mold disk drive in case it is necessary to pull the disk forward while the machine is out of normal.

One method is to observe the position of the mold turning segments. Remember that the short segment causes the mold to revolve one-quarter revolution, or from normal to casting position. The long segment causes the mold to revolve three-quarters revolution, or from casting to ejecting position. The mold disk turns counter-clockwise. Place the gears in mesh so the punch marks on the gears register. Lock the mold slide in position. The drive pinion makes one complete revolution for each quarter revolution of the mold disk, and it goes on the connection pin at any complete revolution. Hold out on the drive pinion and turn the disk and drive pinion by hand the distance indicated by the amount of the segments which have passed the square block drive pinion. When the connecting pin enters the hole in the drive pinion, with the mold in the estimated position, the disk should be in time. Be sure the mold which is being used is the one which is placed in this position. For example, if the short segment and half of the long segment have passed the square block drive pinion, the mold should be turned one-half the distance from casting to ejecting position. To observe what part of the segment is past the pinion, look directly underneath the frame of the machine which supports the mold turning shaft.

Another method of putting the disk in time is to disregard the position of the cams, connect the mold slide, and bring the disk, with the mold that is being used, into ejecting position. Hold the mold turning pinion away from the pin that connects it to the shaft, so that the disk will not

revolve as the machine is set in motion. Pull out on the starting and stopping lever, thus letting the machine run around to normal position. Be sure that the disk locking studs are parallel with the stud blocks before starting the machine.

It is only necessary to let the vise down, disconnect the mold lever from the slide, and put the disk and drive pinion in time.

SHOP PRACTICE

1. At the machine, note how the gear segments on cam No. 3 operate.

2. Examine the shoes on the side of cam No. 3, to see how they operate.

3. Examine the mold turning square block and pinion, to see how they operate, and mesh with the gear segments.

4. At the machine, trace out the connections from the square block and pinion to the mold disk.

5. At the machine, examine the mold turning pinion, and note how it is fastened to the mold turning driving shaft.

6. Remove one of the adjustable shoes from cam No. 3 and note how the adjustable bushing screw is adjusted.

7. Locate the center punch marks on the mold turning pinion and the four center punch marks on the mold disk.

8. Turn the mold disk and pinion by hand and note that one of the marks on the disk is always even with the mark on the pinion.

9. Remove the mold disk driving shaft friction clamp, take it apart, and examine its construction.

10. Replace all parts which have been removed.

QUESTIONS

1. What causes the mold disk to revolve?

2. What causes the disk to stop at the proper places to advance on the locking studs?

3. How are the adjusting shoes adjusted?

4. How is the mold turning shaft connected to the mold turning pinion?

5. What is the purpose of the driving shaft friction clamp?

6. How should the mold disk gears be timed when the machine is at normal?

7. How are the disk gears retimed when the machine is out of normal?

LESSON 23 — VISE, AND JUSTIFICATION LEVERS

The vise (figure 55) is that part of the machine which carries as its main parts, the first elevator slide, the vise justification rods, the trimming knives, the vise automatic, the vise jaws, the slug lever, the mold disk locking stud blocks, the mold banking blocks, and the knife wiper.

The bottom end of the vise is hinged to the base of the machine by a shaft. The top part is locked to the machine by the vise locking screws, which interlock with the vise locking studs on the frame.

To open the vise to first position, push the control lever all the way in, and turn the handles of the locking screws (*a* and *b* figure 55) in a vertical position, in which position they will be disengaged from the vise locking studs.

The vise may be opened to the first position at any time when the mold disk is not forward on the locking studs, or the first elevator is not in the top guide. The vise should never be opened to first position when the mold disk is forward on the locking studs because it is difficult to get it relocked on the studs against the lockup pressure; also there is danger of getting the ends of justification levers out of position under the collars on the justification rods.

To open the vise to the second position, let the machine turn forward until the first elevator is resting on the vise cap (*c* figure 55), just before the mold disk advances. Then lower to first position. Hold the vise up with the left hand, release pawl at the extreme bottom end of vise frame and let the vise down easily, pulling up on the first elevator slide with the right hand. This keeps the link from being damaged.

Never let the vise down to second position unless the first elevator is in the lower position. To do so would throw the weight of the vise on the first elevator lever, with danger of breaking the lever.

The vise locking studs are set at the factory to give the proper alignment of the vise with the mold. The studs often

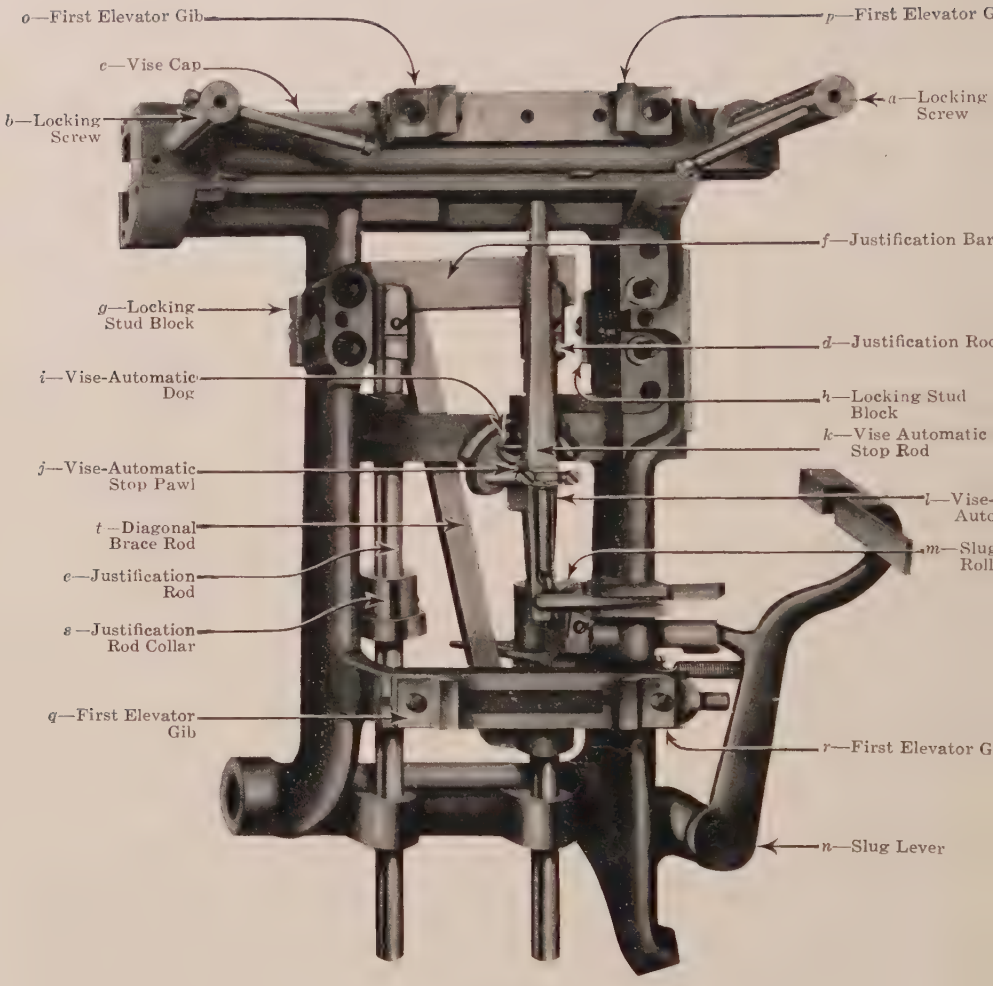


FIGURE 55

This illustration shows the Linotype vise.

have a very thin washer between their back shoulder and the frame to give them the proper adjustment. Should it be necessary to remove or replace a stud, be careful not to lose or leave out the washers. Neither should more washers be added. To do so would force the vise in a strain when locked up, and cause an improper height of the slug.

The Justification Levers. The two justification levers are located under the metal pot and main cams, extend forward from the back of the machine, and connect with the vise justification rods. These levers operate the justification rods (*d* and *e* figure 55) and bar (*f* figure 55), and the vise closing lever. The levers get their motion from rollers which follow the contour of cams Nos. 4 and 5, and are held against the cams by two strong springs in the rear of the machine. The justification bar (*f* figure 55) rests on top of two rods that are forced up and down by the justification levers in guides in the frame of the vise. The rods are connected by the justification bar and a diagonal brace rod (*t* figure 55), the various parts being connected by wing pins. The function of the justification bar is to drive the spacebands upward to justify the line just before the line is cast.

The right-hand lever is called the first justification lever and is operated by cam No. 5. There are two upward movements of this lever: the preliminary, which justifies the line lightly; and the final, which justifies tightly for the cast.

When the justification lever forces the rods upward for the first justification, the rod block moves upward at a slight angle, striking the spaceband at the right-hand end of the line first, and the others in quick succession. This action is so rapid that all the spacebands appear to move upward simultaneously. This causes the line to spread from right to left. After the first justification the spacebands stand at an uneven height, those at the right of the line being a trifle higher than those at the left. Since the line of matrices must fill the entire space between the jaws in order to cast, it is apparent that in order to get the greatest possible freedom of action it is necessary that the matrices be pushed toward the left gradually. Should the rod block come up perfectly horizontal, the spacebands would move to the left at the same time they are moving

upward. This would cause them to drag on the rod block and prevent a good lockup and alignment and a possibility of bending the spacebands. By coming up on a slight angle, each band is practically justified separately in its particular part of the line, and the dragging of the bands on the rod block is greatly reduced.

The first movement of the justification lever operates the slug lever and it also makes a slight upward movement after the slug has been ejected. These movements of the justification lever operate the slug lever, through a roller (*m* figure 55), and push the slugs forward in the stick.

The spring which operates the first justification lever should be strong enough to justify the line properly, regardless of the number of spacebands in the line. Before changing the tension at any time, be sure that the mold slide is properly adjusted. If the mold locks too tight against the line it will bind the matrices and prevent proper justification. This would give the appearance of weak justification springs.

The left-hand lever is called the vise closing lever. It is U-shaped on the forward end. One arm is connected by a hinge pin to the left-hand vise closing wedge and block. The other arm grooves around the left-hand justification rod, beneath a lug on the rod.

After the line is brought to the casting position, the vise closing lever moves upward, immediately followed by the justification lever. The vise closing lever locks the left-hand vise jaw against the line and assists the justification lever on its second movement upward. While these two levers move almost in unison, their functions are different. On second justification, the vise closing lever moves upward slightly in advance of the first justification lever and supports the left-hand end of the spaceband driving block, so that the spacebands are all driven to an equal height. On the first justification, the vise closing lever does not come in contact with the spaceband driving block.

The justification spring is stronger than the vise closing spring. If for any reason the justification springs are removed, care should be taken that they are not changed while replacing them.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figure 55.

2. Let the machine turn forward until the first elevator is resting on the vise cap, and open the vise to second position.

3. Locate the vise locking studs and note how they are fastened to the machine.

4. At the machine, locate the first justification lever, and note its action when the machine is running.

5. At the machine, locate the vise closing lever, and note its action when the machine is running.

6. With the machine running, study the action of the justification levers and block.

7. With the machine running, study the action of the slug lever.

QUESTIONS

1. How is the vise fastened to the rest of the machine?
2. When can the vise be opened to first position?
3. When can the vise be opened to second position?
4. Explain how to let the vise down to second position.
5. How does the first justification lever get its motion?
6. What is the function of the first justification lever?
7. How does the vise closing lever get its motion?
8. What is the function of the vise closing lever?
9. Explain how a line is justified between the vise jaws.
10. How does the slug lever get its motion?

LESSON 24 — VISE JAWS, PUMP STOP, AND STAY BOLT

Vise Jaws. The vise jaws (*a* and *b* figure 56) between which the line is justified, regulates the position of the face of the type on each end of the slug. The mold liner regulates the length of the slug. The vise jaws should be adjusted to have the face of the type flush with each end of the slug.

The short, or right-hand jaw (*a* figure 56) is adjusted by the adjusting screw (*c* figure 52) in the knife block, under the right-hand vise locking pin. When the line is being justified, the matrix on the right-hand end is forced against the face of the short jaw. The matrix on the left is forced against the face of the long, or left-hand jaw (b figure 56) which is held tight by the vise closing wedge (*c* figure 56). The vise closing wedge also acts to unlock the justified line after the cast, so the matrices can be easily withdrawn from between the vise jaws.

When it is desired to change the measure to be set, adjust the left-hand jaw with the adjusting rod, (*d* figure 56). One-half pica is the shortest distance the long jaw can be adjusted with the rod. If it is necessary to adjust less than this distance use the adjusting bushing (*e* figure 56) which screws into the bracket.

Pump Stop. The pump stop prevents the pump lever from operating if the line is not properly justified. The short, or right-hand, vise jaw operates the pump stop operating lever (*a* figure 57). When the line is justified the right-hand jaw is moved to the right against the adjusting screw (*b* figure 57) in the operating lever, which forces the stop lever (*c* figure 57) from under the catch block (*d* figure 57), allowing the pump lever to operate. If the line is not justified the right-hand jaw does not touch the adjusting screw and the stop lever is allowed to remain under the catch block. This prevents the pump lever from descending.

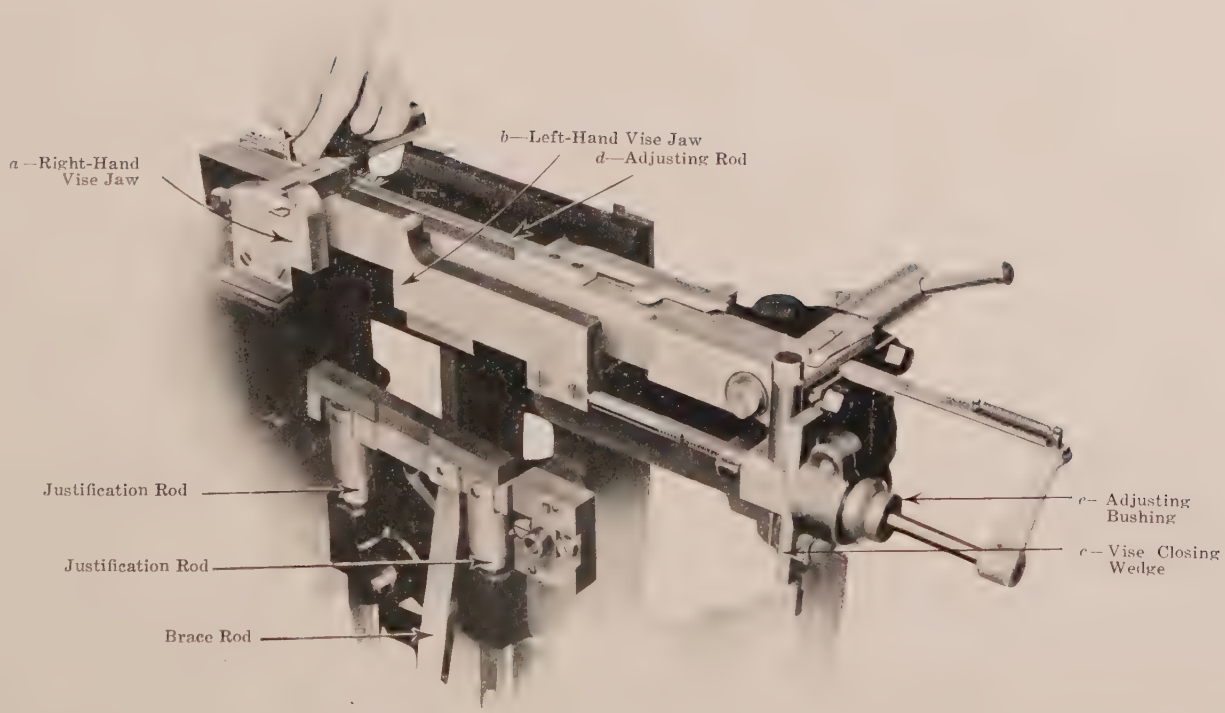


FIGURE 56
This is a back view of the vise.

The pump stop should have $\frac{1}{32}$ of an inch between the pump stop lever and pot lever block when the line is properly justified.

The pump stop lever (*c* figure 57) is connected to a bracket by a screw, and operated by a spring and operating lever. The adjustment is made with the screw in the operating lever.

To test this adjustment, push the right-hand jaw toward the right and observe if the lever is clearing the block the proper distance.

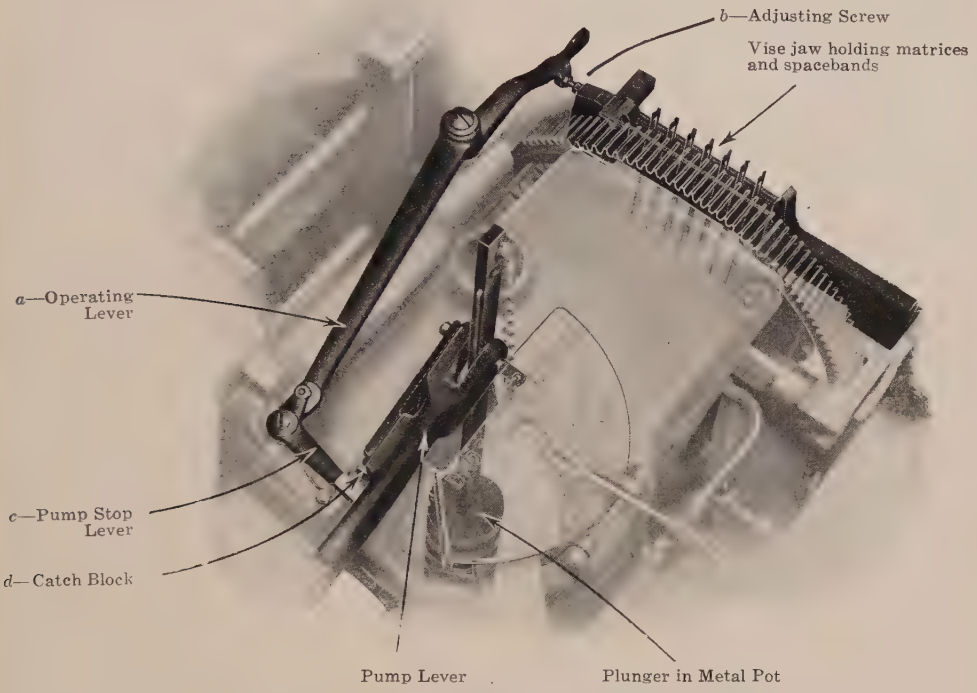


FIGURE 57

The arm which locks the pump stop lever does not move back and allow the pump lever to descend unless the front part of the operating lever is pressed to the right by a completely filled line of matrices and spacebands. If the arm has not moved back, the catch block (on the pump lever) comes in contact with arm below, and keeps plunger lever from descending.

When the line is justified the pump stop operating lever, which is forced to the right by the short vise jaw, should have a trifle extra motion; if not, the position of the letter or character on the right end of the slug would be regulated by the adjusting screw in the pump stop operating lever instead of the adjusting screw in the knife block.

Stay Bolt. The stay bolt passes through the main cam shaft bracket cap and screws into the column. The object of the stay bolt is to take the strain from the column. When the machine is in casting position with the pot locking against the mold, the mold and disk forcing against the vise, and the right-hand side of the vise locking against the stud, there is considerable strain on the column. If the column should spring, the vise would also move and the lockup would be imperfect. In applying the stay bolt, never tighten it with a wrench. If too tight, it will spring the bracket cap and cause the cam shaft to bind and cause undue resistance to the clutch. Screw it in with your fingers until the head of the bolt bears lightly against the bracket.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figure 56.

2. With the machine in action, observe the action of the vise closing wedge.

3. At the machine, observe how the adjusting rod operates the locking pin when changing the measure.

4. Cast a slug and test the adjustment of the right and left-hand vise jaws.

5. At the machine, locate each of the parts shown in figure 57.

6. Remove the plunger pin, turn the machine over without a line and observe how the pump stop prevents the pump from operating.

7. Replace the plunger pin, send in a line to the casting mechanism, and observe how the pump stop is held open.

8. Test the adjustment of the pump stop.

9. At the machine, note how the stay bolt connects the main cam shaft bracket with the column to prevent spring during lockup.

QUESTIONS

1. What is the function of the vise jaws?
2. How are the vise jaws adjusted?
3. How is the measure between the vise jaws changed?
4. What is the purpose of the vise closing wedge?
5. What is the function of the pump stop?
6. How does the pump stop prevent a loose line from casting?
7. How does the pump stop operate to allow a line to cast?
8. How is the pump stop adjusted?
9. What is the purpose of the stay bolt?
10. What would be the result of having the stay bolt too tight or too loose?

LESSON 25 — DRIVING MECHANISM

The machine is driven either by a belt from a convenient line shaft or by an individual electric motor attached to the machine, or by a motor placed in close proximity to the machine and driving the pulley with a belt. The most satisfactory method is the individual motor attached to the machine.

Nearly all machines are now equipped with a motor that is fastened to the machine and which transmits its power through two gears, a small one fastened to the armature shaft of the motor and the big gear on the driving shaft of the machine. The diameter of the big gear or driving pulley is always the same, 14½ inches. The size of the small gear is regulated according to the speed desired and the speed of the motor.

The speed of the driving gear should never be more than 72 revolutions per minute. The pinion (*g* figure 58) on the driving shaft is the proper size so that 11 revolutions of the driving shaft will make one complete revolution of the machine; therefore 72 revolutions of the driving gear or pulley would allow the machine to produce approximately 6½ lines a minute. The speed should never be greater than this for the perfect coordination of the various parts of the machine.

The inside of the driving pulley or gear is milled out smooth so that a friction arm with a leather buffer (*e* figure 60) on each end, fastened to the driving shaft, may be forced into contact with the inside of the pulley or gear and impart rotation to the machine driving shaft.

The driving shaft of the machine is in two sections: the shaft proper, and the short shaft that carries the driving pinion, the two shafts being held together by a taper pin (*f* figure 58). This pinion meshes with the driving gear.

The outer end of the driving shaft is hollow (figure 59). Inside of the hollow shaft is a clutch rod (*c* figure 59) and a spring (*d* figure 59). The spring fits against a collar on this rod and draws the rod inward. The inner end of the

clutch rod is fastened by means of a long screw pin (*a* figure 59) extending through a hole in the rod to a collar (*b* figure 59) which encircles the shaft. The hole in the shaft is slotted, so that when the collar is moved the rod moves also. On the outward end of the shaft is mounted the friction clutch (figure 60), the levers being fastened to the end of

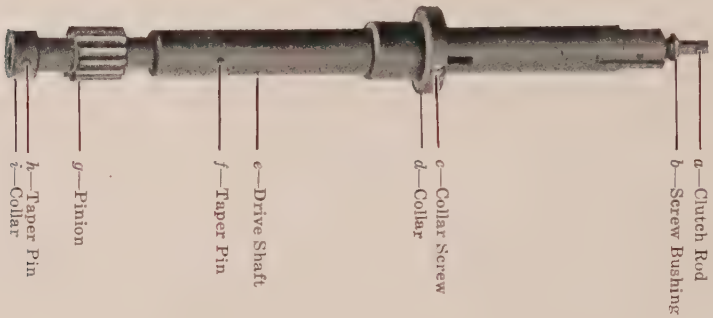


FIGURE 58
This shows the driving shaft, assembled.

the clutch rod. The friction clutch is keyed to the hollow shaft, so when the clutch is turned it also turns the shaft.

Pressure on a forked lever (*o* figure 61) which is fulcrumed to the base of the machine, one end of which encircles the collar and the other end touching the lower stop lever (*m* figure 61), holds the clutch out of action. When the pressure of the forked lever against the collar is released, the clutch spring expands and the clutch rod moves the collar inward until the leather buffers are pushed against the inner surface of the driving pulley, causing the shaft to rotate.

After the machine has made a complete revolution, a pawl on cam No. 10 (*i* figure 61) contacts the upper stopping lever (*j* figure 61) and through the lower stopping lever, forces the forked lever against the collar, throwing the friction out of action.

The Clutch Spring. The clutch spring (*d* figure 59) is held in place by a small collar on the inside of the clutch rod and a screw bushing on the outside, by which the tension of the spring is regulated. This tension should be sixteen to

twenty pounds. A screw pin passes through a slot in the shaft, through the clutch rod, and into the opposite side of the collar. The outer end of the clutch rod is connected to the friction clutch by a screw (*h* figure 60) which passes through the clutch rod. By taking off the clutch and hooking a balance spring in the screw hole in the rod and pulling

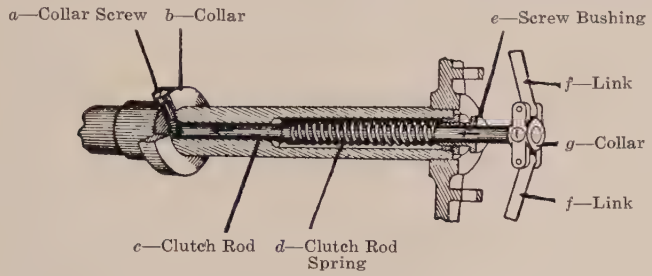


FIGURE 59

This is a cut-out of the driving shaft, showing the clutch rod and spring.

out on the scale, the instant the rod moves the scale indicates the tension of the spring registered. One end of the clutch rod is connected to the collar on the shaft, and the other end is connected to the clutch. When the collar is moved the clutch rod also moves in the same direction.

When the clutch rod spring is adjusted to a tension of 16 to 20 pounds it gives about the right tension to the friction to carry the machine through all its operations where everything is working properly, but if anything sticks or makes the machine run hard, the clutch will slip. Adjust spring with screw bushing (*b* figure 58).

To remove the friction clutch: Push in on the starting and stopping lever. Take out the fulcrum screw (*h* figure 60) from the outer end of the clutch rod. Remove the clutch arm key screw (*b* figure 60). The clutch can now be removed. Be careful in replacing the friction to have the key with the bevel down and toward the back of the keyway.

The driving pulleys or gear can be removed only when the friction clutch is removed.

To remove the clutch rod spring: Remove the friction clutch. Unscrew the screw bushing (*b* figure 58) from the

end of the shaft, take out the screw (*c* figure 58), extending through the collar (*d* figure 58), and pull out the clutch rod and the spring.

If the machine stops on the upper stopping lever with a jerk, the inner side of the driving pulley or the friction

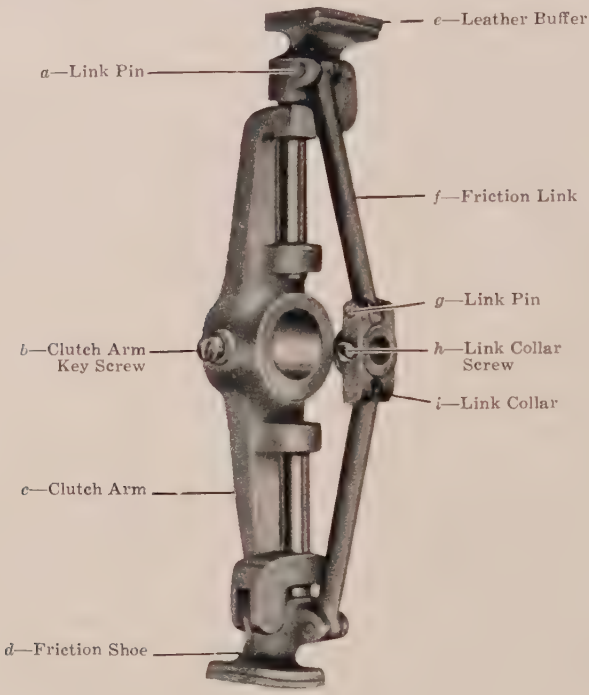


FIGURE 60

The friction clutch.

clutch leather buffers are gummy or the friction is out of adjustment. The inner surface of the driving pulley must be kept clean.

If the machine slows up while casting or ejecting, the clutch is slipping.

The machine will not stop properly when the key screw in the clutch arm works loose, allowing the friction clutch to work toward the outer end of the shaft.

A screw holding the clutch leather buffer in place, may extend above the buffer and cause the friction to slip.

The friction link collar, where it fastens on the clutch rod, should be parallel with the driving pulley or gear when the machine is in operating position; if not, there is unequal pressure on the links and buffers, causing a slipping clutch.

A piece of metal from a squirt lodged between the mold disk guide or back of the rim on the disk will cause it to bind, placing more pull on the clutch.

SHOP PRACTICE

1. At the machine, trace out the connections between the power and the main cams.
2. Count the revolutions of the driving gear and figure the number of lines per minute the machine is running.
3. At the machine, note how the clutch is held out of action by the forked lever.
4. Send in a line and note how the clutch drives the casting mechanism.
5. Shut off the power, remove the friction clutch and study its construction.
6. Remove the clutch rod and spring, and study the construction of the parts inside the hollow shaft.
7. Replace the clutch rod and spring, and test the tension of the spring.
8. Replace the friction clutch.

QUESTIONS

1. What are the common methods of driving a Linotype?
2. At what speed should a machine be run?
3. How is the speed determined at which the machine is running?
4. Explain the construction of the driving mechanism.
5. Why should the machine be driven by a friction clutch?
6. What holds the clutch out of action when the casting mechanism is not running?
7. Explain how clutch drives the casting mechanism.
8. Explain how the machine is stopped after a complete revolution.
9. How should the clutch spring be adjusted?
10. What would cause the clutch to slip?

LESSON 26 — FRICTION CLUTCH, STARTING AND STOPPING MECHANISM

The Friction Clutch. There are seven principal adjustments of the starting and stopping mechanism, the most important of which are $^{15}/_{32}$ of an inch from the collar to the frame, and $^{1}/_{32}$ of an inch from the lower stopping lever to the forked lever (figure 61). These adjustments should be watched carefully as the wearing of the friction buffers will change them. The other five adjustments are important but do not need to be made as often as the first two.

There are three positions of the starting and stopping lever: starting, operating, and stopping. When pulled all of the way out, the lever is in starting position. When the lever is in starting position, the eccentric screw (*d* figure 61) in the starting and stopping lever pulls against the lower lug (*l* figure 61) in the vertical lever and causes the upper lug (*h* figure 61) to force the automatic stopping pawl (*i* figure 61) off the upper stopping lever (*j* figure 61). This sets the machine in action. When the lever is half way out it is in operating position and allows the machine to start when a line is sent in. When the lever is pushed all the way in the clutch is thrown out of action and the casting mechanism is stopped.

When making any adjustments, have the lever in starting position (out as far as it will go). If the automatic stopping pawl is resting on the upper stopping lever, the adjustments can not be made, as the lower stopping lever will be forcing the forked lever against the collar, throwing the friction clutch out of action.

The friction clutch should be adjusted so as to have $^{15}/_{32}$ of an inch between the collar and the shaft bearing. Procure a piece of steel measuring $^{15}/_{32}$ of an inch. (The machine manufacturers sell a gauge made for this purpose.) Place the gauge between the right-hand side of the collar and the left-hand side of the shaft bearing. If the distance is less than $^{15}/_{32}$ of an inch, dress the leather buffers (*e* figure 60) with a file. If the distance is more, place cardboard under

the buffers to increase the thickness. Putting cardboard under the buffers will not satisfactorily drive the machine if something else is wrong. If there is too much packing under the buffers it will affect the action of the upper and

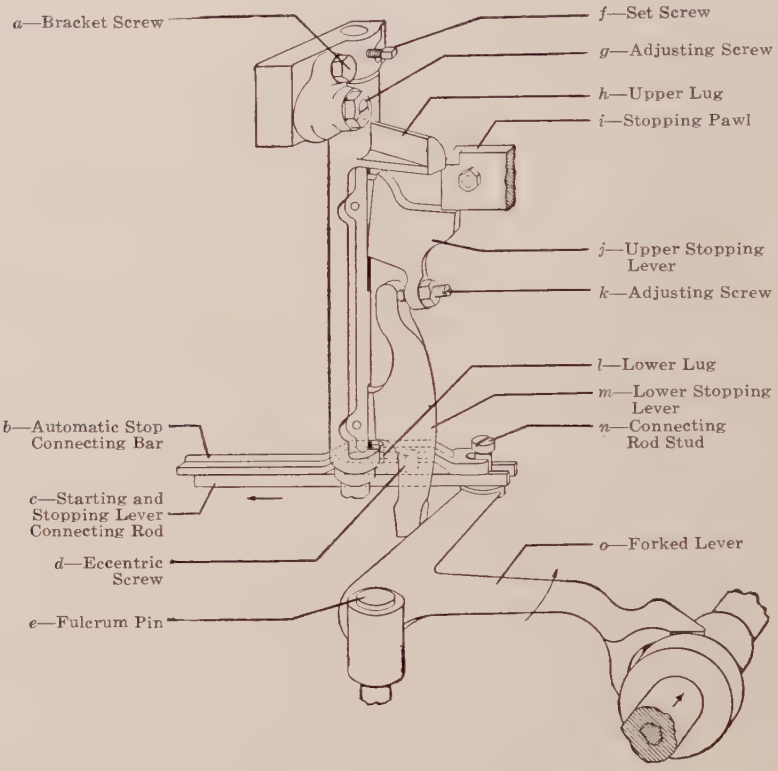


FIGURE 61

This illustration shows the starting and stopping mechanism.

lower stopping levers so they will not throw the clutch out, and the machine will not stop properly.

The upper stopping lever and the lower stopping lever are fastened by pin pivots to a steel shaft which passes through the vertical lever. This allows a limited up-and-down movement of the stopping levers. The shaft is held in position by a set screw (*f* figure 61) in the top of the vertical

lever bracket. When the machine is in action the forked lever must be free of the collar. If it is not, the clutch does not get the proper pressure on the inside of the pulley because the forked lever would push against the collar and force the rod and clutch outward. To be sure the forked lever is free of the collar, adjust so there is $\frac{1}{32}$ of an inch between the lower stopping lever and the forked lever. This adjustment is made by the screw (*k* figure 61) in the lower part of the upper stopping lever.

When the automatic stopping pawl (*i* figure 61) comes to rest on the upper stopping lever, it forces the adjusting screw in the lower part of the upper stopping lever against the lower stopping lever, and the bottom end of the lower stopping lever causes the forked lever to force the collar out, throwing the clutch out of action and stopping the machine. The automatic stop pawl should rest on the upper stopping lever $\frac{1}{4}$ of an inch when the machine is at normal. This adjustment is made by loosening the set screw (*f* figure 61) which holds the shaft in the vertical starting lever, and moving the lever sidewise. When the stopping pawl rests $\frac{1}{4}$ of an inch on the upper stopping lever, the automatic safety pawl will also rest on it exactly the same, as both pawls are adjusted the same.

Fastened to cam No. 10 are two pawls. One is the automatic stopping pawl and stops the machine after it has made one complete revolution. The other is the automatic safety pawl, and stops the machine when a line fails to transfer from the first to the second elevator. These two pawls are adjusted by screws that pass through the pawl and strike the lug of the cam, and are held against this lug with a spring. The distance from the left-hand side of each of the pawls to the left-hand side of the cam should be $\frac{15}{16}$ of an inch.

The vertical lever is fastened to the column, at the back of the machine above the forked lever, by a hexagon-head machine screw (*a* figure 61) at its upper end. The lower end is held in place by the shaft which passes through the lever into the machine frame. The only time the vertical lever is in action is when the machine is started by the starting and stopping lever. On the starting lever is an eccentric

screw (*d* figure 61) which stands behind the lower lug (*l* figure 61) of the vertical lever. When the starting and stopping lever is pulled out, the eccentric screw engages the lower lug and pulls it forward, causing the upper lug to push the stopping and safety pawls clear of the upper stopping lever. There are three lugs on the vertical lever: the upper lug, the lower lug, and the lug inside of the bracket.

There is a headless screw (*g* figure 61) in the vertical lever bracket, the front end encircled by a spring. This spring forces the vertical lever back to its normal position after the lever has been pulled forward by the starting and stopping lever. When pulled forward, the upper lug strikes against the automatic stopping pawl forcing it clear of the upper stopping lever. This adjustment is made by means of the headless screw in the lever bracket. The proper adjustment forces the stopping pawl $\frac{1}{16}$ of an inch clear of the upper stopping lever. The lug inside the bracket should permit the upper lug to clear the stopping pawl $\frac{1}{64}$ of an inch when the lug is at rest. This adjustment is made by turning the adjusting screw in the column opposite the headless screw. This screw regulates the stroke of the inner lug.

Unless the upper vertical lug, after pushing the stopping pawls off the upper stopping lever, returns clear of the pawls, it would prevent the pawls from seating properly on the upper stopping lever.

The adjustment of the lower lug of the vertical lever and the eccentric screw on the starting lever should be made by releasing the set nut on the eccentric screw and turning the screw (*d* figure 61) until there is $\frac{1}{32}$ of an inch between the screw and the lug. If this adjustment is not properly made it will interfere with the upper lug and throw it out of adjustment.

If the friction clutch or the starting and stopping mechanism are not working properly, do not change any adjustments until you are absolutely certain that the trouble is in the adjustment. Very often the trouble may be traced to something binding somewhere on the machine.

SHOP PRACTICE

1. At the machine, study the connection of the starting and stopping lever with the friction clutch, and note the three positions of the lever.

2. Test the adjustment of the distance from the collar to the shaft bearing.

3. Locate vertical lever and study the action of the various parts when the starting and stopping lever is operated.

4. Test the adjustment between the lower stopping lever and the forked lever.

5. Locate the automatic stopping and safety pawls on cam 10, and test their adjustment.

6. With the machine running, note how the automatic stopping pawls come to rest on the upper stopping lever, and test this adjustment.

7. Remove the vertical lever from the machine and study the various parts.

8. Replace the vertical lever and test the adjustment for forcing stopping pawl clear of the upper stopping lever.

9. Test the adjustment which regulates the distance the upper lug of the vertical lever clears the stopping pawl.

10. Test the adjustment between the lower lug of the vertical lever and the eccentric screw on the starting lever.

QUESTIONS

1. In what position should the starting and stopping lever be when making friction clutch adjustments?

2. Give each of the seven adjustments of the friction clutch, and tell how each adjustment is made.

3. Explain how the automatic stopping pawl stops the machine.

4. When does the automatic safety pawl act?

5. What is the purpose of the vertical lever?

6. Explain how pulling out on the starting and stopping lever starts the machine.

7. Explain how pushing in on the starting and stopping lever stops the machine.

8. When should the adjustments be changed on the driving mechanism?

LESSON 27 — VISE-AUTOMATIC

The purpose of the vise-automatic is to prevent the mold from coming forward and shearing the lugs of the matrices whenever anything prevents the first elevator from descending low enough for the first elevator adjusting screw to rest on the vise cap.

The vise-automatic consists of a stop rod (*a* figure 62), stop rod pawl (*b* figure 62), mold disk dog (*c* figure 62), and vise-automatic levers (*d* figure 62).

The stop rod is suspended and held upward by a spring (*e* figure 62), the top end of the rod extending through the vise cap and the lower end resting back of the lever which operates against the vise-automatic connecting rod.

A little below center in the stop rod is the stop rod pawl (*b* figure 62). This pawl is held in place in a slot by a small coil spring which sets just back of the pawl in the stop rod. This spring, in addition to holding the pawl in place, also gives the pawl a little play which allows more of a bite when the pawl is placed in action.

The mold disk dog (*c* figure 62) is held in the vise frame by a screw which extends downward through a slotted hole in the dog. Inside the mold disk dog is a coil spring. This spring is to hold the dog back toward the mold and should be strong enough to keep the mold disk dog pin against the retaining screw when the vise-automatic is not in action.

When the first elevator is in its lowest position the vise-automatic adjusting screw (*f* figure 62) touches the upper end of the stop rod and forces it downward. When the mold slide advances, the mold opposite the one in use pushes the mold disk dog out, above the pawl, and allows the machine to remain in action. However, should the first elevator fail to descend low enough for the stop rod to be pushed down, the dog, as it is advanced by the mold, strikes against the pawl and forces it forward against the vise-automatic levers, stopping the machine.

The mold disk dog must clear the automatic stop rod when the first elevator adjusting screw is resting on the vise cap.

To make this adjustment turn the machine until the first elevator is resting on the vise cap. Move the adjusting screw so the stop pawl will just pass below the dog. To test, have machine in normal position, place a thin matrix on the vise cap under the first elevator adjusting screw (*g* figure 62). Pull out on the starting and stopping lever, set-

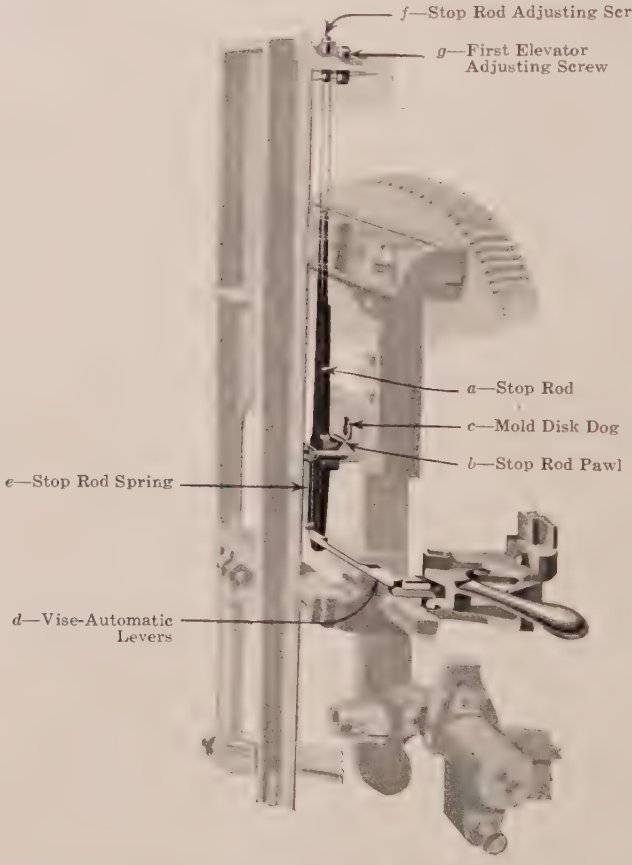


FIGURE 62

This is an automatic, or safety, device. If the operator oversets a line, the casting mechanism is shut off and casting of the line is prevented.

ting the machine in action. The driving clutch should be forced out of action by the vice-automatic in case the first elevator does not go down to its proper position. After removing the matrix the machine should start.

The machine will not stop when making this test, if either the lip of the disk dog, or the pawl is damaged. If damaged or worn, replace with new parts, as the vise-automatic should always be in working condition.

If the machine is delayed in stopping when the vise-automatic goes into action, examine the $^{15}/_{32}$ and $^{1}/_{32}$ inch adjustments on the friction clutch.

When replacing the mold disk dog, be sure that the screw goes between the end of the spring and the cross pin. This is accomplished by turning the screw down until it is below the level of the pin. Then push in on the dog until the pin strikes the screw. Raise the screw slowly until the pin will just pass under the end of the screw, pushing in on the dog while the screw is being raised. Push in on the dog and turn the screw down just inside the pin. The screw will then be between the spring and the pin. Be careful not to turn the screw down on the spring, as it will damage the spring and not allow the dog to operate.

The machine has a four-pocket mold disk, so the dog is pushed forward as the mold slide comes forward in ejecting position. This action of the dog would operate the automatic, throwing the clutch out of action and stopping the machine at ejecting position. To overcome this action, there is a stop rod lever and bracket (*b* figure 63) assembled on the vise frame in front of the automatic stop lever. The lever is fastened to the bracket by a fulcrum screw. One end of this lever carries a small roller, and the other end rests above a pin in the stop rod. The roller runs on a runway at the back of the first elevator slide on the right-hand side. The stop rod is pulled down below the mold disk dog by the lever and remains in this position until the slide moves downward. The roller follows the runway, when, due to a depression, the roller drops, releasing the lever and permitting the stop rod to come to operating position in front of the dog. As the slide moves to transfer position, the lever pulls the stop rod down, bringing the pawl below the dog.

Filling Piece and Safety Lug. Attached to the machine is a filling piece (*c* figure 63) that is known as the simple two-letter attachment. This attachment is fastened by two screws to the vise cap, and when in operating position, it prevents the first elevator from dropping down to lowest

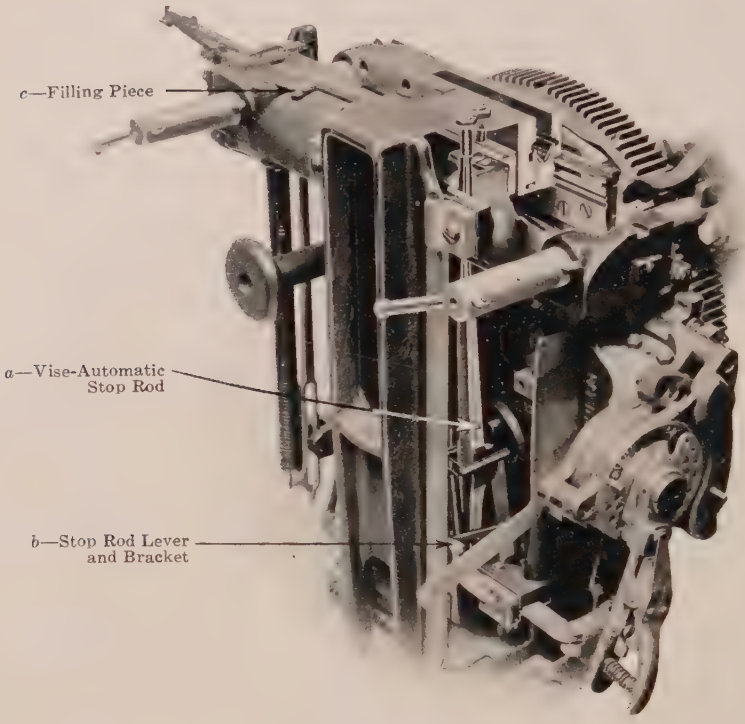


FIGURE 63

This is another view of the first elevator, this time from the right-hand side. It shows the position of the first elevator ot the time of casting.

position. This attachment permits the assembling of a line of matrices in the normal position and casting them in the auxiliary position. Whenever this attachment is used, the duplex rails on the assembling elevator must not be used.

On all machines carrying head-letter or special display molds, the simple two-letter attachment must always be used instead of the duplex rails.

At the left side of these special molds there is a small lug fastened to the mold disk. This is known as a safety stop. When operating a machine equipped with these special molds, if the simple two-letter attachment should not be placed in position, this safety stop would immediately come in contact with a safety plate, fastened to the first elevator back jaw, holding the first elevator off the vise cap and allowing the vise-automatic to stop the machine, preventing a squirt, and damage to the first elevator jaws.

SHOP PRACTICE

1. At the machine, locate each of the parts shown in figure 62.
2. Remove the vise-automatic stop rod and examine the various parts.
3. Remove the vise-automatic stop rod pawl and spring.
4. Remove the mold disk dog and study its construction.
5. Replace the vise-automatic pawl, stop rod, and mold disk dog.
6. Test the vise-automatic adjustment.
7. With the machine running, place a thin matrix under the first elevator adjusting screw and study the action of the vise-automatic in stopping the machine.
8. With the machine running, the first elevator making its full down stroke, study the action of the vise-automatic.
9. Trace out the connection between the vise-automatic levers and the main clutch.
10. With the machine running and the filling piece turned under the first elevator, study its action on the first elevator, and the vise-automatic.

QUESTIONS

1. What is the purpose of the vise-automatic?
2. Explain how the vise-automatic stops the machine when the first elevator fails to descend to the vise cap.
3. How is the vise-automatic adjustment tested?

4. How is the vise-automatic adjusted?

5. How is the mold disk dog replaced after having it off the machine?

6. Why is it important that the vise-automatic always be in good working order and properly adjusted?

7. What prevents the vise-automatic from stopping the machine at transfer position?

8. What is the purpose of the filling piece?

9. Why should the assembler duplex rails not be used when using the filling piece?

10. What stops the machine when a head-letter mold is used and the filling piece is not turned under the first elevator?

LESSON 28 — DISMANTLING AND REASSEMBLING

It is assumed the student has made sufficient progress in his study of mechanism to be familiar with the various parts of the machine before dismantling is permitted. This must be done under the personal supervision of the instructor.

In taking out screws and wing pins always return them to their places, or place them in a box, so they can be found when assembling the machine. All springs and shafts may be easily removed if the pull which holds or binds them is eliminated. Read each paragraph carefully before performing the operations mentioned there, and make sure all instructions have been complied with in each paragraph before beginning the next. Use extreme care in removing the parts, not to break or place any of them in a strain. Study the function and construction of the parts as they are removed so that a better understanding of the machine may be gained by the dismantling.

SHOP PRACTICE

1. If the machine has a gas pot, remove the gas burners. One burner is found under the metal pot and is used to heat the metal in the crucible; the mouthpiece burner is found under the throat of the crucible, beneath the mouthpiece.

2. Remove all the magazines and escapement frames.

3. Remove the magazine frames, locking levers, shafts, and safety guards. Before taking out the lower frame, remove the right- and left-hand guides, fastened to the yoke. Take out four screws holding the frame to the lifting shaft.

4. Remove the line delivery lever and the transfer lever springs. The line delivery and transfer lever springs are found inside the column, and are removed by relieving the tension of the springs, having the slides in the delivery and transfer positions, and forcing them off the hooks. The long

spring is the delivery and the short one the transfer. They are for the purpose of keeping the rollers of the line delivery and transfer levers against cam No. 10, so that the levers get their proper movements.

5. Insert pins in the justification and vise closing lever springs. Pins are inserted in holes in the bottom of the rods in the justification and vise closing spring rods to prevent the springs from slipping off the rods. The justification spring is found under the justification lever in the center of the base, and is used to force the justification block under the spacebands to justify the line for casting. The vise closing lever spring is found under the vise closing lever at the left of the base. This lever is U-shaped, one arm closing the vise jaw against the line, the other, by extra pressure, assisting the justification lever in justifying a line. Care should be taken in replacing these springs in their proper place. The justification spring is the heavier of the two.

6. Disconnect the pump lever spring, having the pump lever all the way down. The pump lever spring is found inside the column of the machine and is used to pull the plunger down and force the metal through the mold cell against the line.

7. Disconnect the left-hand vise jaw closing wedge from the vise closing lever by removing the wing pin. The vise closing wedge is used to lock the jaw against the line when casting.

8. Disconnect the line delivery lever from the slide by disconnecting the link. The line delivery lever is found in front of the column at the back of the face plate, between the transfer and spaceband levers, and is connected to cam No. 10 by a shaft, on which is a split lever and cam roller. It moves the assembled line from the assembling elevator to the first elevator, and while doing so, the roller on the line delivery split lever forces the automatic stop pawl free of the upper stopping lever, releasing the clutch and setting the machine in motion.

9. Disconnect the transfer lever from the link by removing the pin, held in place by a set screw at the top of lever. In replacing, do not push the pin in too far, as it will

bind at the back of the face plate. The transfer lever is found at the back of the transfer channel and operates the transfer slide which moves the line from the first elevator to the second elevator and the spacebands to the pawl.

10. Disconnect the assembling elevator. This is done by disconnecting the link at the bottom of the assembling elevator from the assembling elevator lever. The assembling elevator is the part in which the line is assembled before it is raised to the line delivery slide.

11. Disconnect the spaceband keyrod by removing the wire pin which connects it with the spaceband keylever, behind face plate. The spaceband keyrod is found above the extreme right of the keyboard.

12. Secure the spaceband transfer pawl with a string. This is done to prevent losing the pawl spring. This pawl carries the spacebands from the intermediate channel to the spaceband box.

13. Remove the pump stop operating lever. The pump stop operating lever is found at the right of the pot, on top of right-hand vise stud, and operates the pump stop through the right-hand vise jaw. Remove the pot pump lever stop lever bracket.

14. Remove the assembler entrance cover.

15. Remove the assembler driving belt.

16. Remove the assembler front guide, assembled, by removing seven round-head screws and the special screw near the assembler cover latch. The special screw can be taken out by unscrewing the nut at the rear of the plate.

Note—Before proceeding with No. 17, check up on your previous operations, be sure you have disconnected all the parts mentioned in paragraphs 8, 9, 10, and 11. Be very careful not to drop the face plate when lifting off the dowels.

17. Remove the face plate by removing the three screws which hold it in place. These are found one at each end of the face plate and one near the center, under the line delivery channel.

18. Release the connecting link at the end of the first elevator lever by removing the wing pin. The connecting

link connects the first elevator slide with the first elevator lever. The slide is on the front of the vise, held in position by four gibs. Remove the slide by taking off the two left-hand gibs.

19. Remove the first elevator cam (No. 1). The first elevator cam is found on the left end of the cam shaft, outside of the mold gear arm, and is used to operate the first elevator slide.

20. Remove the distributor shifter spring and lever. The distributor shifter lever and spring are found on top of the mold gear arm and are used to operate the distributor shifter, which pushes the matrices from the second elevator to the distributor box.

21. Remove the mold cam lever, first pulling the mold slide part way out. The mold cam lever is found above the pump lever, and is used to give the mold slide its proper movement forward and backward.

22. Remove the second elevator levers, assembled, first removing starting spring on the side. The second elevator levers, assembled, are found in the rear of the machine, and are connected by a bolt, spring, and two nuts. The starting spring is found connected to the second elevator cam lever on the side near the auxiliary lever, and is used to start the second elevator from the distributor and to keep the roller on the cam. When removing the above spring and lever, have the machine in the transfer position.

23. Remove the justification and vise closing lever shaft. The justification and vise closing lever shaft is found in the rear of the machine under the second elevator lever, and is held by a set screw under the vise closing lever. The shaft can be taken out by driving toward the left with a drift. Remove the first elevator auxiliary lever by unscrewing the hexagon head machine screw that holds the lever to the first elevator lever and loosening set screw that holds the lever to the shaft. The first elevator auxiliary lever is on the outside of the machine, and is used to operate the first elevator slide in connection with the first elevator cam. Take out the levers.

24. Remove the first elevator and the ejector lever shaft. The first elevator and ejector levers are found in the rear of the machine, under the justification and vise closing levers. The first elevator lever is used to operate the first elevator slide. The ejector lever is used to eject the slug through the trimming knives onto the galley. Take out the levers.

25. Open the vise to the second position and remove the mold slide.

26. Remove the mold gear arm by taking out the two hexagon head machine screws at the back of the arm and the two support screws under the mold turning shaft. The mold gear arm is on the left side of the machine, on which is the square pinion, mold turning shaft pinions, and the left-hand vise stud to which the vise is locked.

27. Support the metal pot with a wooden block cut to the proper length. The metal pot is blocked up to prevent falling while removing the cams. Remove the pot pump bracket and lever by taking out two hexagon head bracket screws. Remove the pot lever. Be careful not to lose or mix the washers which are on the pot lever shaft.

28. Remove the tie rod. When replacing be sure that it does not bind. The tie rod is found on the outside of cam No. 10, running through a hole in cam shaft bracket cap, and is screwed into the column.

29. Remove the cam shaft bracket cap. Before removing the cam shaft bracket cap, take off the motor. The cam shaft bracket cap is found over the cam shaft, through which the tie rod passes.

30. Remove the main cams, assembled. Removing the cams means lifting shaft and cams together off the machine.

31. Remove the vertical stop lever by taking out the screw that fastens it to the back of the column.

32. Remove the starting and stopping lever by releasing the screw in wing pin and pulling out the pin. This lever is found in front of the machine under the mold slide, and is used in connection with the vertical lever to start the machine, and with the forked lever and collar to release the clutch from the pulley to stop the machine.

33. Remove the clutch and driving gear. The clutch is found on the end of the driving shaft, inside of the driving gear, and is used to drive the machine.

34. Remove the driving shaft and collar, assembled. The shaft is released by driving out the taper pin which connects it with the driving gear. The driving shaft is found under the cams and is used in connection with the clutch to drive the machine. The collar is used in connection with the clutch rod to release the clutch buffers from the driving gear.

35. Remove the forked lever. The forked lever is found under the cams, and straddles the driving shaft. It is used to operate the collar.

36. Remove the escapement lever guide and the escapement levers, assembled.

37. Remove the key rods, key rod upper guide, and the key rod banking bar.

38. Remove the keyboard. This is done by removing the screws that pass through the base at the bottom of the keyboard, and the screw that connects right side of keyboard machine frame.

39. Remove the magazine elevating levers and brackets.

40. Remove the intermediate bracket. This is done by loosening the three screws that hold it to the column. When replacing, care should be taken that the dowel pins have entered the holes.

41. Remove the distributor box. This is done by turning the handle to the right as far as it will go, then lift box out. Use care not to drop the box.

42. Remove the distributor beam, assembled. This is done by taking out the screws that hold the distributor beam to the distributor bracket.

43. Remove the magazine lifting shaft bracket.

44. Remove the distributor bracket brace. This is done by removing the four screws which hold it to the column. When replacing, care should be taken that the dowel pins have entered the holes.

45. To assemble—reverse the above order. Read each paragraph completely before replacing the part. Be sure to tighten each screw tight.

QUESTIONS

1. What precautions should be exercised when dismantling or reassembling a machine?

2. What benefits have you derived from dismantling and reassembling a machine?

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